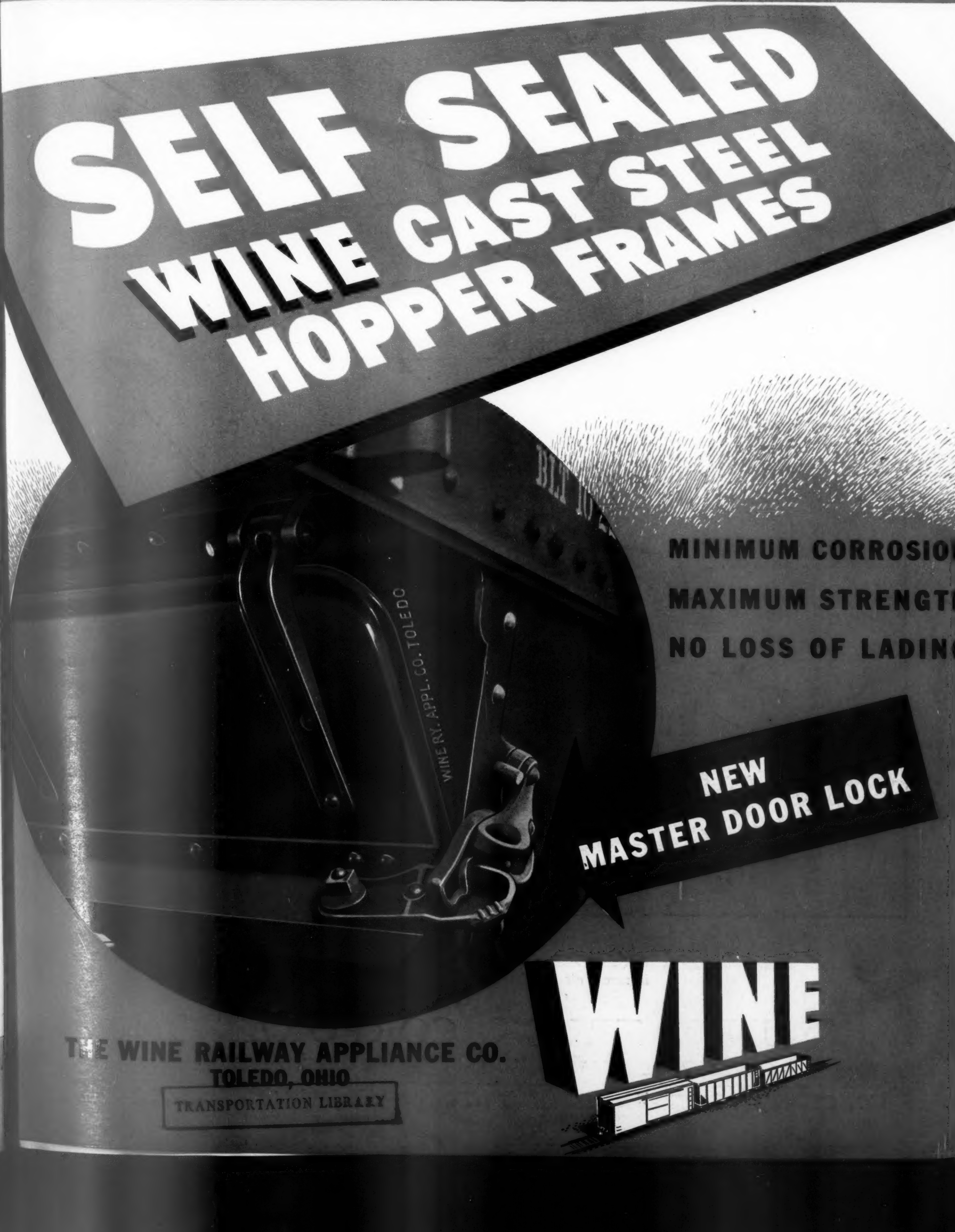
April
1943

Railway Mechanical Engineer

With which is incorporated RAILWAY ELECTRICAL ENGINEER



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"I'm going to shock you!"

"Because I'm going to hit right from the shoulder, starting now.

"Out there, our boys are fighting, and they're falling. Not one or two at a time, picked off by a nice clean bullet. But fifty at a time in the roaring, flaming hell of a shell burst.

"Out there, they aren't walking around in clean white uniforms on neat decks. They're running and slipping around on the bloody heaving flanks of a carrier foundering in a sea of oil with her guts torn out.

"They're not lying in cool, immaculate hospital beds with pretty nurses to hold their hands. They're flat on their backs on cold steel taking a smoke and waiting for a doctor to get through with the *seriously* wounded.

"Out there, they're fighting and they're falling but they're winning! And get this straight —they're not complaining. But I want you to know what they're up against. I want you to know they look to you to give them in *your* way the same full measure of help and devotion they get unasked from their own shipmates.

"And you *can* help them—by giving generously to the Red Cross.

"If you had seen the faces of men pulled naked from the sea as they received kit bags and cigarettes handed out on the spot by Red Cross Field Directors—you'd know what I mean!"

* * *

On every front the Red Cross presses forward. Each day, the need increases for your support.

Your Chapter is raising its Second War Fund in March and April. Give more this year—give double if you can.

THE RECORD SINCE PEARL HARBOR

For the Armed Forces—More than one million and a half service men have received, through the Field Staff, practical help in personal problems. The Red Cross is with them in training and at the front. For morale and recreation, over one hundred Red Cross Clubs have been established for overseas troops. There are more than five thousand workers in the field.

Civilian Relief—About sixty million dollars in war relief has been administered in every allied country. Food, clothing, medicinal supplies have gone to Great Britain, Russia, China, Africa, for Polish and Greek refugees, and many others.

Thousands of packages to prisoners of war have been safely delivered through cooperation with the International Red Cross in Switzerland.

The Home Front—Training our people to meet the needs of war. Millions of First Aid Courses. Hundreds of thousands trained in Home Nursing and Nutrition Courses. Thousands enlisted as Nurses' Aides and in Motor and Canteen and Staff Assistant Corps.

More than one million and a half blood donations through Red Cross collection centers and the distribution of the life saving Plasma wherever needed.

Chapter Production rooms from coast-to-coast providing surgical dressings for the wounded, kit bags for the fighters and tons of clothing for relief.

The Red Cross record in this war is one that we Americans may well be proud of—and support.

Your Dollars help make possible the

AMERICAN RED CROSS

This space contributed by the Publisher

THE EDITOR'S DESK

AFTER THE WAR

We have been hearing a great deal for many months about post-war economic planning, with a view to stabilizing business, industry and employment. Many groups, private and governmental, as well as individual corporations, are devoting much time and attention to these post-war problems. A governmental agency, the National Resources Planning Board, has already sent recommendations to Congress. These particular reports, incidentally, are of the typical New Deal type and tend toward the future adoption of government ownership and operation of transportation.

What, if anything, is being done to offset this tendency toward government ownership? An exhaustive answer cannot be given here, but mention may be made of two significant movements which should receive the co-operation and support of those who are interested in maintaining that fundamental upon which this country has been developed—the spirit of free competitive private enterprise.

One group, the Committee on Economic Development, which is privately financed, recognizes the fact that production and employment must be maintained at a high level in the post-war era; otherwise there is a grave probability that we may be driven to a planned economy or collectivism—an outstanding characteristic of the Axis nations, with which we are today battling. It has its headquarters in the Commerce Department Building at Washington and is definitely planning and busily working on a constructive program to prevent such a catastrophe.

Another group, the Transportation Association of America, has recently retained ex-Congressman Samuel B. Pettengill as its vice-president and general counsel. It recognizes the dangerous New Deal trend toward government ownership and collectivism. It recognizes, also, that the first inroads will be made upon transportation, and particularly upon the railroads. The heavy industries will come later. In light of this it apparently intends to concentrate its attention upon the prevention of government ownership of the railroads. Few men, if any, are so well equipped to lead an effort of this sort as Mr. Pettengill, because of the long and active part that he has taken in sponsoring good railroad legislation.

It would appear that one other job remains to be tackled, although no specific organization seems to have made much headway with it thus far; that is, to eliminate or effectively control the great number of bureaus that, once established in either federal or state governments, gradually reach out their tentacles and, at needless waste and expense to the taxpayers tend to usurp the functions of government.

Here are worthwhile tasks that require our hearty participation and co-operation.

Roy V. Wright

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RAILWAY
MECHANICAL ENGINEER

One of the auxiliary dining cars

1942-Built

Milwaukee Passenger Cars

Thirty-one cars turned out of Milwaukee shops do yeoman service in helping the railroad handle 74 per cent more traffic than in 1941—Trucks are another step in evolution started on this road in 1938

The Chicago, Milwaukee, St. Paul & Pacific built last year at its company shops, Milwaukee, Wis., 31 new welded all-steel passenger cars, including 2 diners, 2 auxiliary dining cars, 2 passenger-baggage cars and 25 coaches. This new equipment, built primarily for the Hiawatha, constitutes the fourth edition of the train since it was first inaugurated in May, 1935, and includes entirely new equipment except for the parlor and beaver-tail cars. The replaced cars, substituted in other trains, helped meet the urgent demand for additional passenger equipment and undoubtedly were an important factor in enabling the Milwaukee to handle a record-breaking passenger traffic, both war and civilian, in 1942. The number of passenger miles increased from over 565 million in 1941 to about 984 million in 1942, or roughly 74 per cent.

Authority for building this new equipment was given early in 1941 and some material was ordered at that time. However, where improvements were under development, the ordering was necessarily delayed and, as war requirements increased, one material after another was made unavailable for passenger-car construction. As a result, innumerable substitutes were required which made construction of the cars difficult from a production standpoint and seriously added to the car weight. Low-alloy, high-tensile steel was obtained for only a portion of the car parts. In past designs, aluminum had been extensively used for air-ducts, piping, hardware, etc., and in its place low-carbon steel had to be employed. For instance, steel tubing was used for all furniture in place of aluminum; hair and spring upholstery in place of rubber; windows had to be made without the use of either brass or aluminum; many car specialties including coach seats and lighting fixtures were not obtainable from the usual sources of supply and substitutes were made and fabricated at Milwaukee shops.

The new cars include as special features an improved truck design with Budd disc-type brakes; redesigning the car body to meet both the original Post Office Department specification and the latest revised A.A.R. specification for passenger cars; adding of skirts to the car body; redesigning vestibule diaphragms and face plates; introduction of a connecting tunnel diaphragm in the vestibule; insulation of draft gears; use of Waukesha propane-engine-driven air-conditioning and lighting equipment; new design of coach seats; improved heating; fluorescent lighting; new window construction, and new interior finish material.

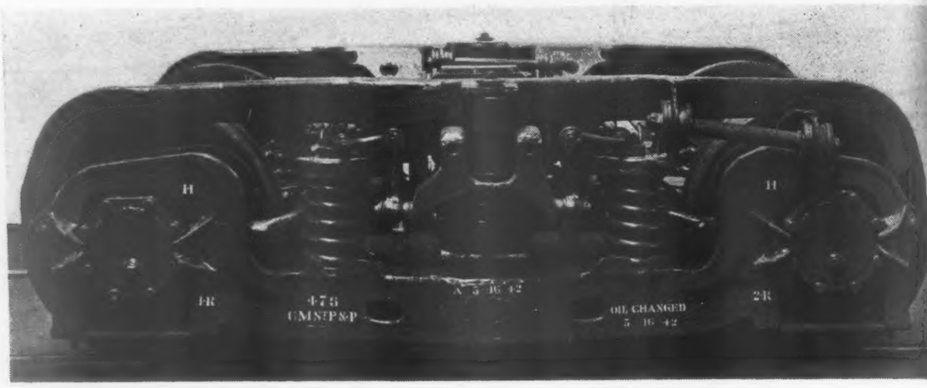
Considerable cross-sectional area was added in the car body to meet the two specifications mentioned which were treated as separate engineering problems. To

comply with these specifications, it was deemed necessary to increase the cross-sectional area in the roof considerably so that the component of buffing stresses carried by the underframe would be balanced in the roof. The introduction of the skirts also added to the weight of the car and unfortunately, although exceptional care was taken to insulate the car from a sound-deadening standpoint, the noise level is somewhat higher than the low point achieved in cars previously built. While the skirts undoubtedly add to the appearance of the car, they have nevertheless introduced complications in the operation and repair of the equipment. Air circulation for cooling purposes is restricted in summer and especially in winter when tons of ice accumulate on the car underframe, a condition not experienced with previous cars.

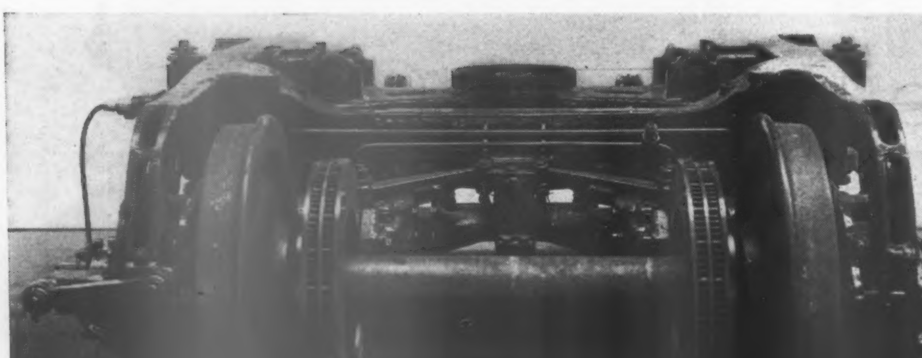
The same general type of welded steel construction is used in these cars as in previous Hiawatha equipment, the length being about 82 ft. over coupler pulling faces; width over side posts, 10 ft.; and height, 13 ft. 1 in. to the top of the rail. The passenger-baggage car, with a 36-ft. baggage room and a passenger compartment seating 40, weighs 125,700 lb. Other car weights are as follows: Coach, 126,700 lb.; auxiliary diner, 129,000 lb.; diner, 139,500 lb. The figures given are ready-to-run weights.

The coach has a main passenger compartment 48 ft. 10 in. long, seating 56 and a smoking lounge in one end seating 12, thus giving a total seating capacity of 68. The usual modern wash-room facilities are available in the other end of the car. The auxiliary diner has a 29-ft. compartment in either end with a seating capacity of 26 each, separated by a 9-ft. 4-in. buffet section well equipped to serve lunches and refreshments to a large number of civilian passengers or military personnel as required. The dining car seats 48 in the main room; it has a 9-ft. 6-in. pantry and an 18-ft. 9-in. kitchen.

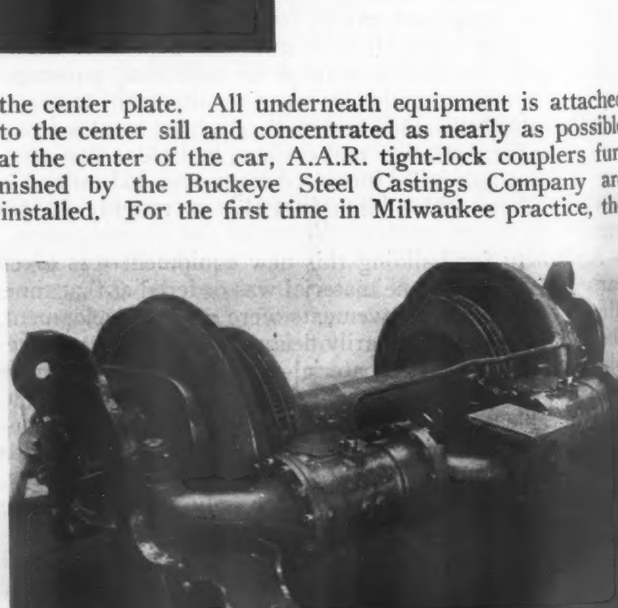
Each car roof consists of four sub-assemblies of two side plates, two short-radius side plates and two long-radius top sections. These sub-assemblies are built 39 ft. 9 in. long and then fabricated into a completed roof on the roof jig. The side frame is constructed with a two-element side sill, one welded into the side frame and the other into the underframe. The entire car frame is spot and arc welded. The car is equipped with a platform cast integral with the body bolster. The platform casting is attached to the center sills by welding beyond the center plate. All underneath equipment is attached to the center sill and concentrated as nearly as possible at the center of the car, A.A.R. tight-lock couplers furnished by the Buckeye Steel Castings Company are installed. For the first time in Milwaukee practice, the



The four-wheel truck has relatively light frames



The truck frame is laterally positioned by links to one of the equalizers



Details of the Budd brake application

How the lighting fixtures and basket racks are installed

cars are equipped with skirts $15\frac{7}{8}$ in. deep extending the full length of the car. The skirt is the full depth even at the steps. Doors are cut into this skirt for the removal and inspection of the underneath equipment.

In order to assure a well-insulated car, Fiberglas, $2\frac{1}{2}$ in. thick, is applied in the floors of 11 coaches and Stonefelt in the balance of the car floors. Car sides, roof and ends are protected by a $2\frac{1}{2}$-in. thickness of Stonefelt, applied in the form of a continuous blanket with just as few breaks in the material as possible. Liquid asphaltum is sprayed on the inside surfaces of metal sheets for insulation and sound deadening. Felt stripping is applied between inside finish and the side posts. Cork board, $2\frac{1}{2}$ in. thick, is used to insulate ice boxes, bottle lockers, etc. Where necessary, piping is insulated by the application of Wovenstone pipe covering.

Features of the Truck Design

The trucks represent several years of research and experimental work on the Milwaukee, the first part of which was described in an article beginning on page 862 of the Railway Age issue of May 20, 1939. Eventually a car set of cast-steel trucks, embodying new principles of design, was developed and secured from the General Steel Castings Company. The outstanding feature is the use of equalizers extended to include the functions of conventional pedestal jaws. With the exception of the contact with the roller bearing housing at the top

Tubular steel frame of one of the new coach seat units

forming a lateral pivoting point, there is no contact or wearing surface between the box and the equalizer.

The wheels, axles and bearings are oriented with respect to the truck frame by the use of drawbars and the Budd brake C-frame, the latter being modified so that it is not necessary to remove any part of the brake frame in order to change a pair of wheels. The inner element of the early type of two-element journal box, so successfully used on Milwaukee passenger cars, forms a crowned inner housing for the Timken roller bearings. Urschel-Pittsburgh hollow heat-treated carbon-steel axles are used. With the introduction of this axle and the maintenance of 6-ft. 4-in. journal spacing for trucks of all capacities including 6 in. by 11 in., the Milwaukee has adopted one standard roller bearing and will gradually have one standard axle on 350 roller-bearing cars, a highly-important advantage from a coach-yard maintenance standpoint.

The bolster coil springs of the truck, $13\frac{5}{8}$ in. in outside diameter, have a free height of $22\frac{3}{8}$ in. and a riding height of $13\frac{1}{2}$ in. This high free to load deflection gives the low frequency rate needed when the car is operating at high speeds. The coil springs are controlled at their unstable period, between 5 and 10 miles an hour, by Monroe hydraulic shock absorbers designed for approximately 2,000 lb. on rebound and 600 lb. on compression at the natural period of the spring. The shock absorbers are stem mounted between the truck

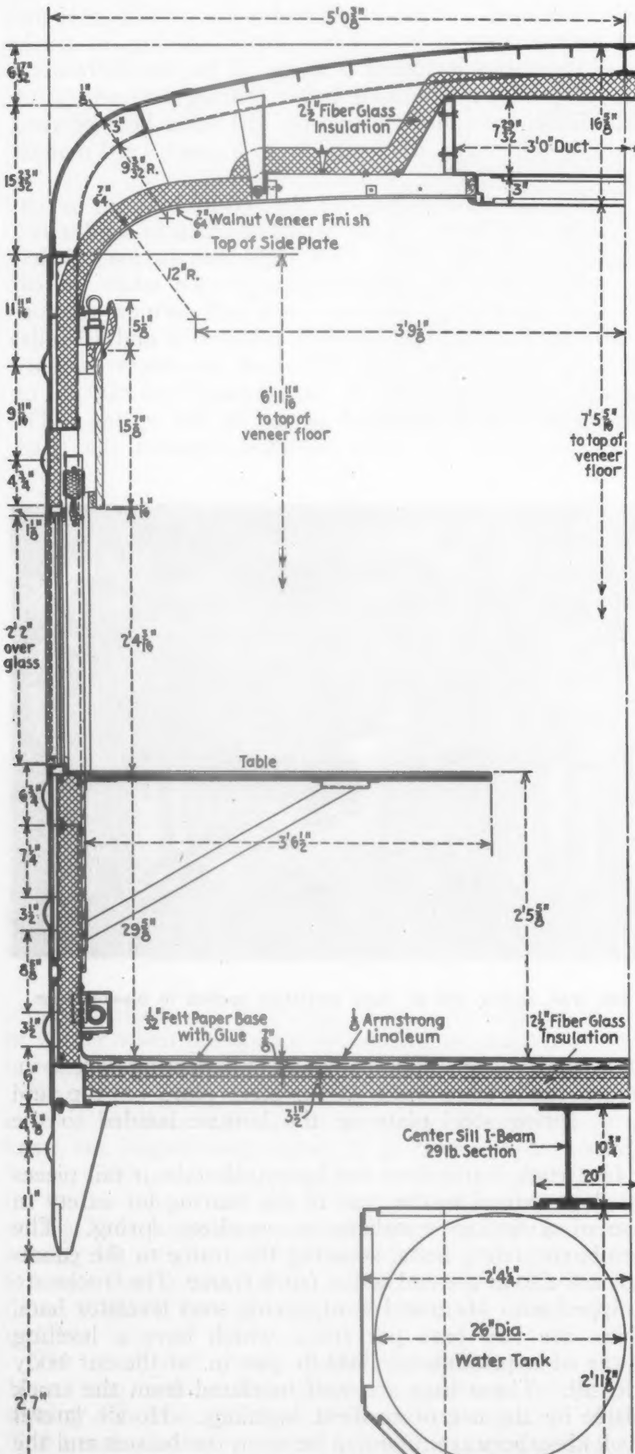
Side wall, ceiling and air duct insulation applied in blanket form

frame and bolster. The car-body side bearings are 1-in. rubber sandwiches with $\frac{1}{8}$-in. steel plate on top and $\frac{3}{8}$-in. spring steel plate on the bottom bonded to the rubber.

The truck frame does not have pedestals or tail pieces but does extend to the rear of the bearing for safety in case of a broken equalizer or equalizer spring. The derailment safety bolts, securing the frame to the equalizer, are also at the end of the truck frame. The trucks are equipped with Monroe $1\frac{3}{8}$-in. spring steel levelator bars. There are two bars per truck which have a leveling power of approximately 900 lb. per in. at the car body side sill. These bars are well insulated from the truck bolster by the use of resilient bushings. Houde lateral shock absorbers are mounted between the bolster and the spring plank controlling the lateral motion of the large bolster coil spring on the passenger-baggage cars, diners and auxiliary diners.

The Rolokron anti-wheel slide device, developed by the Budd Wheel Company, is applied to the truck with

the registers mounted in place of the roller bearing box covers, and a control box mounted under the car body. The register flywheel is spring driven from the end of the axle. When the retardation rate reaches between 15 and 20 m. p. h. per sec., the driving spring is sufficiently compressed to close a set of contacts which energizes the solenoid valve of the control box. This solenoid valve is a three-way valve controlled by a relay in such a way that the brake-cylinder pressure is exhausted for one second. At the same time the air from the triple



Half-section through the car body

valve is shut off. At the end of the one-second interval, the relay valve de-energizes the solenoid, allowing the air from the triple valve to be restored to the brake cylinder. The wheel by this time should be again traveling at relative track speed. If the wheel again tends to slide, this process will be repeated.

The air brakes are Westinghouse Schedule H.S.C.

Improvements in passenger truck design, as exemplified in the new Milwaukee truck include: (1) Entire elimination of center plate wear by the introduction of heavy bonded steel-rubber pads, which make lubrication unnecessary and, in fact, undesirable; (2) side bearing adjustment eliminated by the use of thick bonded steel-rubber pads which are applied with a light initial compression; (3) elimination of elliptic springs with their unknown frictional resistance and replacing them with large helical bolster springs of constant capacity; (4) elimination of pedestal liners with consequent wear on liners and journal boxes; (5) elimination of friction plates between bolsters and transoms and controlling the movement of bolsters by means of rubber-mounted bolster drawbars and levelator bars; (6) positioning the equalizer with respect to the truck frame by means of lateral and longitudinal rubber-mounted drawbars.

Realization of the improvements mentioned has resulted in a practically noiseless design and eliminated all wear in contact surfaces in the entire truck with the exception of the pins supporting the spring plank hangers. By virtue of the lateral flexibility of the large equalizer springs, the wear of the spring plank hangers and pins is materially reduced. Although the truck was designed to be interchangeable with the heaviest cars in Milwaukee service and a liberal allowance was made in the design of the axles, the total weight for two complete trucks is 34,080 lb.

Each of the friction draft gears, of the Miner type, is held in a cast-steel enclosure attached to the platform casting through three-well-insulated connectors. The draft gear functions in a normal manner inside the enclosure. The use of the enclosure affords large surfaces for the insulators which would not be possible with the usual construction.

The buffer stem has been pinned back so that it does not contact the buffer channel until the draft gear has been compressed ¾ in. This insulates the buffer center stem from the buffer channels by the simple expedient of avoiding contact except under extreme conditions. The high absorption value of the buffer is still retained for safety in collision. The buffer diaphragm face plate and the outside enclosure face plate are held together by means of insulated links. This assembly is in turn mounted on the car body by an insulated adjustable link. The outside enclosures are No. 6 canvas.

The Air-Conditioning Installation

Air-conditioning equipment consists of a Waukesha Model-D heavy-duty four-cylinder internal combustion engine with four-cylinder V-type refrigerant compressor, having a capacity of 7½ tons in 24 hrs. and using Freon as a refrigerant. A sub-cooler is also installed to provide maximum capacity in extreme weather. The fuel system consists of a four-cylinder cabinet, propane cylinders and necessary valves.

The ice engine, sub-cooler and fuel cabinet are located directly under the center of the car. The ice engine can be rolled out to clear the side of the car on specially constructed tracks, supported from the side sill of the car, the skirt at this point being easily removable. This equipment employs a split evaporator which functions

Interior of auxiliary diner equipped to serve lunches and refreshments

to keep a more uniform load on the compressor by cutting out two-thirds of the evaporator coils when the desired car temperature is approached. It also tends to maintain a more uniform humidity.

At one end of each car, a Young Radiator Company's overhead roof-mounted blower unit is installed, constructed according to specifications submitted by the railroad. The blower capacity is 2,000 cu. ft. per min. with 0.7-in. W. G. external resistance, the cooling coil being copper-tube fin-type type with a working pressure of 400 lb. per sq. in. and a maximum suction pressure of 38 lb. per sq. in. The design calls for 550 cu. ft. per min. of fresh air, outside temperature 96 deg. F. dry bulb; 78 deg. F. wet bulb; inside temperature 74 deg. F. dry bulb, 60 deg. F. wet bulb. The overhead unit is mounted on four rubber vibration insulators on metal supports fastened to the roof carlines. Accessibility is afforded by means of a roof hatch for removing the unit proper.

Fresh air is taken into the car at the vestibule end through an opening in the end sheet and by-passes itself to a plenum chamber where three 15⅞-in. by 19⅞-in. by 4-in. Farr air filters are mounted in an inclined position to obtain as much free area as possible. In addition a 22-in. by 11-in. recirculating grill opening is located directly underneath the plenum chamber to maintain proper balance between the fresh and the recirculated air. Air delivery is through Pyle-National Multi-vent center ceiling panels.

Electric power for lights and accessories is secured from a Waukesha heavy-duty four-cylinder internal combustion engine with directly connected mechanically-cooled generator of special design, having heavy-duty roller bearings, fully enclosed. Fuel is obtained from the same cabinet that supplies the ice engine. The propane cylinders are unloaded in sequence by the usual controls. The engine is started and stopped automatically in accordance with the electrical load by means of controls on a suitable panel on the generator unit. This unit is mounted in the same manner as the ice engine and can also be rolled out for servicing.

A 2.5-kva. Safety Car Heating and Lighting Company's single-phase 60-cycle motor-alternator is installed to furnish 110-volt current to lights and outlets This unit is also attached to the center sill. Starting power for the ice engine and generator is furnished by Exide batteries carried in a box under the center sill. The installation includes A. & J. M. Anderson charging receptacles.

The cars are heated by the latest type Vapor Car Heating Company's zone-control system. This method of car heating employs the use of several zones or areas, each with its own thermostat and thus assures a more uniform temperature throughout the car body. The heating equipment also includes new types of valves and regulators which are designed to give quicker response, thereby avoiding the usual wide temperature differential.

The coach seats, designed and manufactured at Milwaukee shops, are reversible and reclining with the seat and back integral, similar to a rocking chair. When the back is reclined the seat also rises. The seat-reclining motion is controlled by means of right and left hand nuts, clamping a small pitman rod secured to the seat base. The seat frame is made of 1-in. square tubing bent to shape and welded. A combination of steel springs and rubberized hair is used in the seat cushions and backs in place of sponge rubber.

Interior Finish of the Coaches

Notwithstanding the difficulty in procuring desirable materials, the interior finish of these cars includes certain definite improvements and innovations. The window construction was an outcome of experience obtained in applying the Pittsburgh Plate Glass Company's hermetically sealed double-glass unit to cabooses built about three years earlier and followed up and tested under adverse climatic conditions. The unit used consists of ¼-in. Duplate safety glass on the outside and ¼-in. Solex plate glass on the inside, separated by an aluminum spacer to provide a 3/16-in. air space between the lights. The edges of the unit are hermetically sealed by means of asphalt tape. The glass unit in turn is mounted in a rubber extrusion and secured to the unique prefabricated window frame, which also carries the window shades or Venetian blinds. A second rubber extrusion is applied directly to the window opening in the car body. A weather tight seal is obtained by suitable pressure between the two extrusions.

The inside finish consists primarily of Robertson bonded metal. Linoleum facing, cemented to the bonded metal, is used under the basket rack where it forms an effective light reflecting surface. The bonded-metal curved ceiling over the basket rack is faced with walnut veneer and extends up to the Pyle-National metal air-

One of the coaches with the fluorescent lights on

duct. Linoleum is also employed at the ends of the car to create the desired color scheme and to give a practical inside finish which can be readily cleaned of finger

Method of applying the roof structure to the body of one of the coaches built at the Milwaukee shops

marks and dirt. In the women's and men's smoking compartment there is a large mirror opposite the door opening.

General car lighting is secured from 110-volt a.c. fluorescent lights, while a 32-volt Mazda shielded night light is installed at each pilaster panel. The lighting was first studied on a full-size section of the car and various conditions and combinations of fixtures tried out until the desired over-all effect was obtained. The fluorescent lights, located immediately above the windows, are separated by the night lights. A plastic shield is used to hide the direct glare of the fluorescent tubes, with the linoleum mentioned above serving as a reflector for the indirect light. The night lights are shielded by small colored-glass star-shaped ornaments.

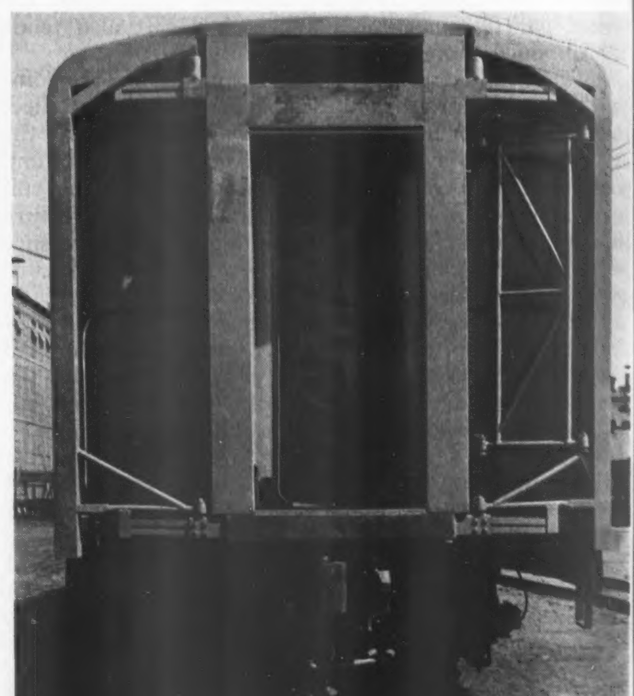
The Auxiliary Dining Car

An entirely new design of auxiliary dining car serves as a practical car for operation next to the dining car. The overflow from the diner is prevented from obstructing service to patrons in the auxiliary dining car, without any appreciable sacrifice in the seating capacity, by means of a full-length corridor and locating the kitchenette in the center of the car, with one waiter serving in each end.

The outstanding ornamental features of the auxiliary diner is the glass-enclosed, illuminated flower box in which plants are placed for decorative purposes. In addition, large ornamental hand-carved wood plaques are located on the side wall of the car, with ornamental mirrors on either side. These wooden plaques represent characters in Longfellow's poem, Hiawatha, and are also applied as wall decoration in the dining cars.

Decorative Treatment of the Dining Cars

The ceiling of each of the dining cars, including No. 113, or Car A and No. 114, or Car B, is divided into three distinct parts. On the steward's end of Car A, the finish of the flat bulkhead underneath the blower is made up of Guana Costa veneer. The center circular air outlets, including the car body panel, are painted a light gray. The side panels of the ceiling to the Pyle-National air-distributing panel is made of zebra wood, vertical grain which includes the coving in the car. On dining Car B, the side panels, coving, and the bulkhead, including the flat ceiling under the blower, are all made of Guana Costa veneer. The flat ceiling at the kitchen end of Car A is zebra wood, vertical grain; on Car B, Guana Costa. All coving and side panels on both cars are made on bonded metal backing. The shield of the fluorescent light trough is made of solid walnut wood with three holly strips inlaid horizontally. The solid walnut trough shield underneath the flat ceiling is re-



End view showing the suspension of the diaphragm and outer enclosure face plates

placed by a translucent glass shield on the side, giving an ornamental effect. The vertical and bulkhead partitions, having gold-tint mirrors mounted in uniformity with the window-sill height, give the dining section the appearance of a larger room. The dining-car chairs, including 32 in each center section and 16 in each end section were also made of steel tubing at Milwaukee shops. They are upholstered in either green or gold plush.

The interior decorative treatment of these cars was developed by Otto Kuhler. The drapes were furnished by L. C. Chase & Company and the upholstery materials by Chase and the Collins & Aikman Corporation.

The Key to Logistics*

By F. K. Mitchell†

Disregard of railroads' need for more cars and locomotives and for adequate manpower and material for repairs risks a military collapse

Our military leaders have long realized that victorious operations can only be achieved when they are able to have that which is needed in the necessary quantities where and exactly when it is needed. They have recognized the achievement of that end as a science. They have called that science "logistics."

Our transportation leaders have likewise long realized that successful railroad operation requires exactly the same fundamental elements. They have not recognized it as a science, but have unconsciously developed it into one. If called anything, it was "good railroading."

The railroads normally need varying quantities of almost every known raw product, manufactured article, food, clothing, supply, and personnel. As always, in war time, the military forces had need for exactly the same things as did the railroads. Therein lies the complication which makes the procurement of "that which is needed" by the railroads one of the most gigantic undertakings yet faced by them.

The Railroads' Own Logistics Problem

While the revenue ton-miles in 1942 went up 68.8 per cent over 1940 and the revenue passenger-miles went up 123.1 per cent during the same period, the purchases of materials and supplies went up only 40.3 per cent. In October, 1942, the actual ownership of locomotives was three per cent less than in October, 1939. During that same period we had only increased our freight-car ownership 5.6 per cent and the number of our passenger-carrying cars (exclusive of dining, lounge, mail, baggage and express) had decreased 1.6 per cent. It is quite obvious, then, that our actual procurement of materials and supplies did not increase in proportion to our traffic increase. Shortly after the outbreak of war we estimated that by October, 1942, we should have 974 new locomotives and 113,594 new freight cars. We actually were allowed to install 783 new locomotives, an increase of only 4.8 per cent, and 80,874 new freight cars, an increase of only 1.9 per cent. In this instance again our procurement in nowise paralleled our increased traffic demands.

Equipment Requirements and Prospects in 1943

Type of equipment	Estimated requirements	Authorized	Probable needs above the present authorized
Locomotives:			
Freight	1,399	446*	953
Passenger	583	None	583
Switch	606	306	300
Cars:			
Passenger	2,266	None	2,266
Freight	105,650	20,000	85,650

* Includes 123 5,400-hp. Diesel locomotives, only 36 of which will probably be built in 1943.

The Association of American Railroads began an analysis of the situation with the assistance of other agencies and the railroad officers generally. These studies pointed definitely to certain programs which involved the augmentation of improved procurement methods with substitution, conversion, reclamation, and intensified utilization.

Improved methods of material and supply procurement was primarily a problem handled by the purchases and stores departments. Within their own departments they set up new agencies for the purpose of maintaining closer contact with the needs of other departments and with supplier and regulatory bodies. About the time they had relearned the alphabet and its new letter combinations and knew a priority from a directive, a new material procurement plan was sprung on them. Their chins are still up, however, discouraged though they must be, and with anything like an even break they will not fail where success is at all possible.

Substitution has been the problem of every railroad man. Typical of substitutions not found successful are the use of hot-drawn for cold-drawn tubing in the manufacture of bushings in spring and brake-rigging parts; malleable iron for bronze in certain gate- and globe-valve parts; iron for copper pipe on high-pressure steam lines in locomotive cabs; gun iron for bronze rod bushings on high-speed locomotives, and plain for coated welding rod used in welding alloy steels.

Typical of substitutions which will probably be at least fairly satisfactory for the duration of the war are enameled or painted carbon-steel parts for chromium or nickel-steel parts used in the trimming of passenger cars; carbon steel for alloy steel in the manufacture of locomotive parts, such as rods, motion work and boilers, and car parts such as sheets; friction for roller bearings on locomotives and cars; wood instead of steel for the floors of gondola cars; gun iron for aluminum or bronze crosshead shoes, and perhaps for rod bushings on switching power; silver for zinc solder; linoleum for carpet floor coverings; spring cushions for foam-rubber cushions; gray iron for bronze shoes and wedges, and female for male employees on many lighter types of work.

Notable among the substitutions which will probably be even more satisfactory than the old style materials are Insulmat for wood in cab linings; Satco metal for bronze hub liners on locomotive engine truck, trailer and driving wheels in some classes of service, as well as for lining of journal bearings; malleable for brass washout and arch-tube plugs; steel for bronze in the manufacture of bells, and plastics for critical metals in many parts.

Conversion of plants and equipment has gone on apace. Power plants and locomotives have been converted from

* Abstract of a paper presented before the New England Railroad Club on February 9, 1943.
† Assistant general superintendent of motive power, New York Central.

oil to coal burners, Pullman chair, observation and lounge cars, mail and baggage cars; yes, even box cars have been converted to coaches. Box cars have been converted to cabooses; box cars and cement container cars have been converted to oil-carrying cars; locomotive shops have been converted to handle war work, such as the manufacture of engines for Liberty ships, tank parts, armored car parts, etc., and the labor agreements have been revised or converted to meet the emergency.

Reclamation as a means of reducing the consumption of critical materials has been particularly productive. In the general picture the most spectacular results have been evident in the scrap drive conducted on all railroads as a part of the National Scrap Campaign. As indicative of the results of this drive Class I railroads shipped to dealers and consumers during 1942 nearly 4.5 million net tons, or approximately a million more net tons of scrap than in 1940. Less spectacular, but perhaps of more permanency in the effect on the general situation, is the introduction of new reclamation processes. For example, building up driving- and trailer-wheel centers by the Unionmelt process when below service limits; metal spray reclamation of crank shafts and many other parts; development of welding processes hitherto untried, such as the welding of spring steel for driving, engine-truck, trailer, tender and car semi-elliptical springs, and the tipping of cutting tools where the former practice was to make the entire tool, shank and all, of high-speed steel. The last-mentioned process is noteworthy for its results in that it not only produces just as satisfactory a cutting tool, but makes possible the using of every small piece of tool steel formerly scrapped.

A Record Equipment Utilization

	1940*	1942*	Per cent improvement
Per cent of active freight locomotives to total (October)	70.4	87.8	24.8
Average freight locomotive-miles per month, (total locomotives) (October)	2,249	3,198	41.9
Miles per day per active freight locomotive	107.5	122.5	13.9
Miles per day per active passenger locomotive	190.8	204.5	7.2
Per cent of unserviceable freight cars	5	3	40.0
Freight car-miles per active car per day	42.2	50.6	19.9
Average freight-car load, net tons per car	27.6	31.5	14.1
Average freight-train load, net tons per train	849	1,030	21.3
Net ton-miles per train hour	14,028	16,216	15.6
Passenger occupancy per train	60.7	115	72.0

* Figures for full year 1940 and first ten months of 1942, except as indicated.

These reclamation processes, and many others, have resulted in making tons of critical metals and materials available for the production of war materials.

While on the subject of reclamation, I might say in passing that the railroads, through recalling retired employees to service, lowering physical requirements, and raising the upper age limits for hiring, job instruction training, intensifying safety activity, improving sanitary and working conditions, have reclaimed many manhours which have made a corresponding number of men available to the military services.

Increased Utilization a Great Accomplishment

Our efforts toward greater utilization of such motive power, cars and equipment as we have available to us have produced results never paralleled in history. If anyone has the idea that these things were accomplished without heartbreaks, sweat and, perhaps, tears by every class of railroad employees, his conception of the task is dwarfed by ignorance or indifference. Perhaps the most appreciative groups outside the railroad circles, are the shippers (who by their cooperation had made many of these things possible), the suppliers, and the military authorities. The loyalty, devotion to duty, and quiet patriotism which has helped make the solution of the railroads' own logistics problem thus far possible is a thing that you and I can even now hardly comprehend.

Demands of Military Logistics Growing Fast

There are now in our military forces some five and one-half million men. We are told that this figure is to be increased to at least seven million. Every one of these men must be hauled at least five times before he goes overseas. From the time of his induction into the service until his discharge every pound of food he eats, clothing he wears, equipment and tools he uses, his weapons, ammunition, medical and surgical supplies, both in the stage of raw materials and completed articles, must be transported largely by rail.

It is estimated that in 1942 troop movements and men traveling on military or naval leave resulted in the handling by American railroads of nearly ten million military men in organized groups of fifty or more, also that counting all individual and organized group movements, 15.7 billion passenger miles were produced. Assuming that this movement will increase in proportion to the size of our armed forces, when the seven million figure is reached, we can expect to have to haul 12,700,000 men in organized groups annually and produce for all military and naval travel 19.9 billion passenger-miles annually. In 1942, 15 per cent of all railroad coaches and 40 per cent of all Pullman cars were used continuously for group movement of troops. Since practically no coaches or Pullman cars are being built, unless some adequate relief along these lines is afforded, about one-quarter of all available coaches and half the available Pullman cars will be continually in use by our armed forces when the seven million figure is reached.

The movement of one so-called "triangular" infantry division requires some 65 trains and 1,350 cars. The movement of one armored division requires 75 trains, varying from 28 to 45 cars each. During some months in 1942 as high as 3,000 special trains were moved. When the military personnel reaches seven million men, this special movement may well be expected to reach as high as 3,800 trains in a single month.

Even more enormous is the job which may be expected to fall on the roads, due to the increased demand for handling military supplies and equipment. During 1942, they handled 630 billion ton-miles of freight as against 475 billion for 1941. Not all of this increase was due to military requirements, but it is probable that most of it was. On that basis, approximately 155 billion military ton-miles were produced. Assuming that this load will increase in direct proportion to the increase in men in our military forces, it may be concluded that when their number reaches seven million we will have a military freight load of 195 billion ton-miles annually, 40 billion over the present load.

Abstractly considering these facts, certain probable equipment requirements can be forecast. In 1942, approximately 7,000 passenger locomotives produced 50 billion passenger-miles, or 7.2 million passenger-miles each. An increase of 4.2 billion passenger-miles due to increased military travel would then require 583 additional passenger locomotives. In 1942, 22,000 freight locomotives produced 630 billion ton-miles, or 28.6 million ton-miles each. An increase of 40 billion ton-miles due to increased military requirements would require 1,399 additional freight locomotives. In 1942, 27,75[illegible] passenger cars produced 50 billion passenger-miles or 1.8 million passenger-miles each. On this basis, 2,26[illegible] additional passenger cars would be needed. In 1942

1,690,570 freight cars produced 630 billion ton-miles, 378,600 ton-miles each. On this basis, 105,650 additional freight cars would be needed. Assuming that the ratio of switch locomotives required would be the same as the present ratio of switch to freight locomotive ownership, approximately 908 added switch locomotives might be required. Readjusting this estimate on the basis of Diesel switch locomotive performance and assuming that all switch locomotives procured would be of the Diesel-electric type, approximately 606 new locomotives might be needed.

Contrast these estimated needs with the equipment authorized thus far in 1943 (see the table).

It is recognized that many factors will no doubt influence the accuracy of the abstract requirement figures quoted. As overseas supply lines are lengthened and the number of men overseas increases, the quantities of material and supplies lost will increase and the quantities enroute will likewise increase. Greater amounts of fuel oil and naval supplies will be needed for the transportation of these things overseas. These military forces may be increased even beyond seven million, and naval forces may also increase in nearly the same proportion. These and similar, perhaps unforeseen, circumstances may make the estimates low. Reduced civilian requirements, changes in military training and tactical plans, the production of satisfactory synthetic rubber in large quantities, completion of contemplated pipe lines, and similar circumstances may make the estimates high. We must, however, plan for the future in such a way that, regardless of what happens, our equipment needs will be adequate. Only by so doing can our part of the military logistics job be met successfully.

The Railroads Face Five Handicaps

What are we faced with in fulfilling our obligation to get these military supplies and materials delivered to the point where needed in the quantities needed, at the time they are needed?

First—An acute manpower shortage, growing even more so. In 1940 we had on the Class I roads, 1,026,848 employees and in 1942 had increased that by 22½ per cent to 1,270,000, while the freight load went up 68.8 per cent and the passenger load went up 123.1 per cent. We have lost between 8 per cent and 10 per cent of our forces to the military services and between 22 per cent and 25 per cent to other industry in addition to our normal losses through mortality, retirement, etc. Many wise and productive schemes have been set in motion to aid in keeping our manpower up to the requirements. Yet even now there are an estimated 60,000 positions vacant. We will work out our own salvation as far as it is humanly possible, but must have the support of the selective service boards and the Manpower Commission.

Second—A continued and even more difficult job of material procurement for our own ever increasing needs. In this situation we realize the problem with which the various governmental agencies are faced, but also that while some officials of those groups are sympathetic to our necessities, others are not. They do not yet realize that we must have material when it is needed, that if we wait for a locomotive to be out of service before a directive or an emergency priority is given, and the return of that locomotive to service is delayed just one day, 78,383 tons of war materials will be just one mile farther from the place where it is needed.

Third—An actual equipment shortage that is not being corrected as rapidly as we feel circumstances demand. Here again, governmental agencies charged with the responsibility of new equipment procurement and allocation could help more if its officials were unanimous in their opinion that our needs are actually a part of, and not secondary to those of the military and naval forces. There is probably only one governmental agency or department that really has that conception of the picture.

Fourth—Deferred maintenance becoming necessary due to lack of manpower and material, plus our inability to hold equipment out of service long enough to make essential repairs. Every railroad man knows when that snake in the grass issues its warning hiss there is trouble ahead. We have already heard the warning. It must be killed before it can raise its head to strike.

Fifth—An apathy on the part of the general public, not conducive of forcing their political leaders to recognize that the railroads are the Number One key industry in the war effort. Perhaps we are, as much as anyone, responsible for this; we have heretofore done a poor job of selling ourselves to them. We must overcome this failure; that is your job and mine.

The time has come when the railroads must be accepted as and accorded the action necessary to support them as the Number One key war industry. Unless that acceptance and accord are forthcoming future generations will wonder why this one was so shortsighted as to cripple the life line of transportation in a time as critical as this!

Are We Copying Germany's Mistakes?

Of what avail to MacArthur, Montgomery and Eisenhower, Timoshenko, or Nimitz are a million men that they cannot get when and where they need them; a million tons of ore at the mines, when it is needed in tank steel; a hundred thousand tanks in Detroit when they need them to start or support an offensive; a million barrels of oil in Texas when it is needed in the holds of their ships, or ten thousand airplanes on the front line and the gasoline for them in tank cars somewhere in these United States waiting for locomotives to move them?

A wall paper hanger by the name of Schikelgruber conceived the idea, in his paste-filled mind, that such things could be prevented by employing other means than his railroads. His own railroad people plead with him to allow them to put his railroads in shape to do the job. I know that to be a fact, for when he finally was coerced into doing something about it he sent a committee over here to study our railroads and their methods preparatory to instituting a rehabilitation program. Those men spent some time on the railroad for which I was working and I drew the job of accompanying them. I still have their business cards. They would have done the job, and done it right, but by the time they were ready, war had already broken out and they were denied the materials and equipment with which to do it. Today in Germany the railroad situation is desperate. Schikelgruber is frantically appropriating the equipment from conquered countries, trying to patch it up and again restore the transportation element of his logistics problem to its normal adequate functioning through railroad transportation.

In England the situation on the railroads is none too healthy. This is not because of any shortsighted policy or delusion that their railroads were not a definite factor in the British logistics problem. Destruction of roadway, structures and equipment through bombing, in addition to the added war load, is proving more than they can handle. We are helping straighten out that situation by furnishing men, facilities and equipment. You have had it revealed to you through pictures of American built locomotives being unloaded in England.

As the link is to the chain, as the hub is to the wheel, as the engine is to your automobile, as the machine tool is to production, so the railroads are to military logistics. If they function adequately, logistics will continue to be a science, if not, it will deteriorate into a chaotic muddle.

Nickel in Railroad Service*

By B. B. Morton†

BEFORE dwelling upon the effects of nickel in railroad equipment, I would like to point out the remarkable versatility of nickel as an alloying element. It has been said that nickel alloys with nearly all industrially used elements with benefit to the existing alloy or element.

In ferrous metals nickel is invoked to harden and also to soften. For instance, consider Ni-Hard cast iron, one of the hardest of irons and Ni-Containing grey cast iron, soft and machineable; it affects the coefficient of thermal expansion and is used to decrease and also to increase it. In this connection, it may be pointed out that nickel-containing alloys are made with practically zero coefficient of thermal expansion at room temperature and other alloys are formed that will match the coefficient of expansion of aluminum. Jigs of this latter alloy are admirable for use with aluminum. The magnetic characteristics of materials are affected by nickel. On one hand we have the strongly non-magnetic alloy K-Monel which is used in directional drilling of oil wells and for many other uses and on the other hand we have the Alnico type of permanent magnets that are famous for their magnetic properties. The corrosion resistance and heat resistance of the high chromium alloys are enhanced by nickel additions. In fact, the most corrosion resistant of the alloys such as the Hastelloys, LeBour metals and others contain large percentages of nickel. The remarkable alloys of monel (nickel-copper) group indicate the possibilities of the combinations in which nickel predominates. Brass in which nickel has replaced zinc to form the 70/30 copper nickel alloy has contributed tremendously to the war effort as condenser tubes, fire lines of ships, etc. One of the spectacular uses of nickel is to protect the impact property of steel at low temperature and an outstanding example is the storage spheres for methane in liquid form at —260 deg. F. The inner low temperature spheres are of 3½ per cent nickel steel.

Effect of Nickel on Steel and Iron

In steel, nickel enters into solid solution with the ferrite and tends to strengthen this component. It does not form a carbide, as do many other alloying elements. This is considered a distinct advantage, since it permits the use of low carbon steels where high strength, toughness and weldability are desired. An important characteristic of nickel steels is that for a given value of ductility as measured by elongaiton the strength will exceed that of carbon steels. In general the ductility of nickel steels at high strength is outstanding.

Nickel slows up the rate of transformation of stee and ferrous alloys, thereby providing a desirable latitude in heat treating operations. With large percentages of nickel or in combination with chromium transformation is so retarded that the steel may remain austenitic (as evinced by low order of magnetism). As examples of austenitic steels the 18 per cent chromium—8 per cent nickel alloys and the steels containing 32 per cent or more of nickel are cited.

Nickel exerts a profound influence upon the mechanical properties of cast irons. Up to about 3 per cent additions of nickel are used to prevent chill spots and to precipitate graphite. These irons are used where free machining is desired in combination with good strength. By special manipulation these low alloyed irons can be given very high strength up to 80,000 lb. per sq. in. The Ni-Tensyl group of high strength irons, often under various trade names, have made a good reputation for themselves. With further increases of nickel 4 to 7 per cent and with the addition of chromium, irons of great hardness are produced and find use to resist abrasion. Such irons find application especially in mining and dredging operations. With additions of 15 per cent to 35 per cent with and without other elements the non-magnetic, austenitic irons are formed and are widely used to resist various forms of corrosion as from sea water, caustic, sulphuric acid, etc. The austenitic irons also possess a high degree of heat resistance. By varying the nickel content the coefficient of thermal expansion of the austenitic irons can be controlled within certain limits.

Table I—Typical Properties of Hot-Rolled 2 Per Cent Nickel Boiler Steels

(Shell plates)

C	Mn	P	S	Si	Ni	Yield Point, lb. per sq. in.	Tensile Strength, lb. per sq. in.	Elong. in 8 in. per cent	Red. area, per cent	Izod impact, ft.-lb.	Remarks
0.19	0.67	.018	.024	0.21	2.16	54,800	77,600	28.2	55.3	....	¾ in. plat (transvers specimens
0.18	0.59	.020	.022	....	2.25	46,600	77,000	28.0	61.0	65	1 in. plate (longitudin specimens

Fatigue Failure

Service on the railroads is severe and steels of unusu toughness are desired. Failures of running equipme can in 90 per cent of the cases be ascribed to fatig failures (often referred to as crystallization by the pra ticing mechanic).

While it may appear presumptuous here to outli conditions of fatigue failure, especially in view of the e cellent dissertations on the subject presented by Fr Williams, test engineer, Canadian National, and othe a brief summary will be offered in order to throw so light on the subsequent discussion.

* Abstract of a paper presented before the Canadian Railway Club, Montreal, Que., March 8, 1943.

† International Nickel Company.

In general, fatigue failure occurs when a repeated ress of an intensity greater than the endurance limit cts upon a part over a period of time. The main con-rolling factor is the intensity of the stress, since this alue controls the number of reversals necessary to pro-uce failure and hence the time for failure to occur.

Dealing with laboratory specimens highly polished and ently handled, one obtains a value for an endurance imit and this value is close to one-half the ultimate rength. It is further noted that stresses below the alue of the endurance limit fail to produce rupture over long period of time and a very large number of rever-als. In practice, the endurance limit is not a sharply

potential is the destructive power that great care in specifying and choosing a steel for such a boiler is justified.

Nickel steels due to their mechanical properties which embrace high impact values in the as-rolled plate have been widely used as the material for locomotive boilers. Table I. An outstanding performance of nickel steel boilers has been on the Canadian Pacific. The author has not been able to date to discover the reason for the good performance of the boilers of the Canadian Pacific as compared with boilers of the same material of roads in the States. The reasons may be many and are undoubtedly complex but the excellent preparation and construction of the boilers must play an important part.

Table II—Typical Properties of Normalized Low-Carbon Nickel-Steel Forgings*

(Normalized around 1475 deg. F., drawn 1050-1200 deg. F., Brinell hardness 170 to 180)

Composition, per cent						Yield point, lbs. per sq. in.	Tensile strength, lbs. per sq. in.	Elong. in 2 in. per cent	Red. area, per cent	Approx. size, in.
C	Mn	P	S	Si	Ni					
0.24	0.99	.018	.023	0.23	2.65	61,200	86,200	29.0	63.3	Main pin 10 in. dia.
0.24	0.81	.021	.024	0.23	2.65	60,400	84,200	30.5	60.4	Main axle 11 in. dia., 3¼ in. hole
0.25	0.84	.020	.022	0.25	2.65	64,900	85,400	33.0	69.5	Main rod 7 in. x 9 in.
0.24	0.78	.016	.021	0.18	2.60	61,700	85,200	31.0	66.6	Piston rod 7 in. dia.

*Izod impact values obtained were between 70 and 80 ft.-lb. At comparable tensile strengths normalized and drawn plain carbon steel with 0.50 per cent carbon has an Izod value around 15 to 25 ft. lb. with a yield point of only about 45,000 lb. per sq. in. Properties on tests taken at mid-section.

etermined stress value but varies downward with size f section and chiefly with the condition of the surface. he condition of the surface is considered to intensify e stress, or to lower the endurance value as obtained r the same material from polished specimens. So arked is the variation in practice from the polished pecimens that few people consider the piece in service o have definite or at best a determinable endurance limit nd good practice appears to be to expose the part in ervice to frequent tests by Magnaflux or other means r determining the presence of incipient or developed racks. It is known, and Mr. Williams has especially rought out, that scratches, punch marks or any irregu-r distortion of the surface will result in premature fail-re by parts in fatigue. Sharp changes in direction and ress fits contribute to failure. Hardening, i. e. strength-ning, of the surface offers one of the best means to-

Typical Properties Taken from Mid-Section of Forgings, Oil Quenched from 1,475 deg. F. and drawn at 1,200-1,250 deg. F.

Part	Yield point, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elong. in 2 in., per cent	Red area, per cent
Piston rod—6½ in. diam.	75,900	104,800	25.0	47.1
Driving axles—10½ diam.	73,800	93,200	30.0	62.3
Crank pin—10½ in. diam.	75,500	96,000	29.0	59.0

The rotating beam fatigue limit on specimens cut from the mid-point of forgings of this type is around 57,000 lb. per sq. in.

The whole explanation cannot reside in the construction, since the engineers of the Canadian Pacific have been most generous with their information so that comparable construction can probably be found. Other factors must be sought to explain the difference in performances. It is quite possible that length of boilers and operating factors account for the differences in operation noted.

In general it would appear that boiler failures occur

Table III—Cast-Low-Carbon 2 Per Cent Nickel Steel

(Representative properties on test coupons treated with the castings)

Type treatment: 1700 deg. to 1850 deg. F., air cooled; 1500 deg. to 1550 deg. F., air cooled; drawn 1000 deg. to 1200 deg. F.

Composition, per cent			Yield point, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elong. in 2 in., per cent	Red. area, per cent	Izod impact, ft.-lb.
C	Mn	Ni					
.18	0.93	2.20	53,300	84,000	30.0	61.0	59
.18	0.85	2.26	51,500	81,000	29.0	55.5	62
.19	0.81	2.20	50,000	80,500	28.0	59.0	56
.17	0.82	2.18	50,800	80,200	30.5	62.5	64
.17	0.84	2.10	51,000	79,000	32.5	62.5	55

wards elimination of fatigue failures. Even means of ardening offer some dangers and one should consider he work by Dr. Horger[2*] and others before attempting o treat a part, especially by flame hardening.

Nickel in Locomotive Boilers

Locomotive boilers are usually designed by applying a actor to the ultimate strength of the steel used. It fol-ows then that weight reduction is dependent upon the ltimate strength of the plate. Other requirements be-ides strength are required, since a good degree of duc-ility, as measured by elongation, is considered necessary nd general excellence of the plate is desired. So enor-ous is the energy stored in a locomotive boiler and so

from at least three main sources, namely low water; caustic embrittlement and fatigue failures.

Low water is considered the chief source of boiler failures that reach catastrophic proportions.

Caustic embrittlement is a center of acrimonious discussion. Failure of parts is often attributed to this source. The excellent work of Dr. Schroeder, Bureau of Mines and Dr. Straub, chemical engineering department University of Illinois, has done much to enlighten the public on the subject of caustic attack and to alleviate its consequences. Caustic embrittlement appears to be dependent upon three principal factors; a joint that leaks just enough to allow concentration of caustic salts; a heavy stress in the metal and the absence of inhibitors as the nitrates; tanning extracts, etc., which have been found effective as preventors of this type of embrittle-

[*] This and subsequent numbers indicate reference to bibliography, page 169.

ment. Other factors, as types of salts, appear also to bear upon this form of attack.

Experience seems to indicate that no steel is immune to caustic embrittlement under conditions favorable to such attack. The use of inhibitors promises some relief but each condition favorable to embrittlement has to be studied as a separate case and often a specific inhibitor must be developed.

Removal of the type of joint conducive to caustic embrittlement appears to be the most logical approach to the problem of eliminating this type of failure. The welded boiler, stress relieved and X-rayed, would appear to be the most promising solution to the problem. Nickel steels such as used for riveted boilers[8] offer themselves as the ideal material for welded boilers. The petroleum industry has made generous use of welded vessels of low carbon, 2 to 3 per cent nickel steels especially for use at sub-zero temperatures. The vessels so fabricated have given excellent service to date. It is recognized that the element of fatigue is more prevalent in the locomotive boiler than in the vessels of a refinery, hence fatigue data are more important.

Certain tests of welded 0.19 per cent carbon, 2.38 per cent nickel steel plate welded with a rod developing 0.08 carbon and 1.89 per cent nickel in the weld are under way to throw light upon the usefulness of the 2 to 3 per cent nickel steels for locomotive boilers. Endurance limit of weld metal and metal adjacent to the weld will be made. The plate shows 70,000 to 75,000 lb. per sq. in. ultimate, and the weld 75,000 lb. per sq. in. ultimate strength. The elongation in plate and weld is 27 per cent and 24 per cent respectively. All bend tests have been readily met. The results of the tests, including the endurance limits will be published when completed.

Some evidence of failure of boiler parts in pure fatigue has come to attention. Very long boilers must be considered as ideal fatigue subjects and must be guarded by reducing the tendency of the track forces to treat the boiler as a cantilever beam. Failure of this type will usually be noted in the girth beam in the throat section. Wear plates and other parts are subject to reversals of stresses and hence to fatigue failure. Vibration is a fruitful source of rapidly reversed or varying stresses that can bring on fatigue failure of parts from which vibration are not dampened or which, like springs, have not been designed specifically to withstand such stresses. Failure of springs indicate the potency of varying stresses to produce failure.

Firebox Sheets; Staybolts

The firebox of a locomotive undergoes grueling ser[vice]. The sheets of the firebox expand due to the tem[perature] involved in driving heat into the water. Ex[pansion] is restricted by the restraining action of the end[s] and by the staybolts. The stresses due to thermal ex[pansion] are so great that distortion of the firebox shee[ts] often occurs at an early stage of their life.

Two per cent nickel steels 0.17 carbon (max.)[8] hav[e] been widely used for side sheets and crown sheets. Th[e] results obtained are erratic and depend, as might be ex[pected], upon operating conditions.

Failure chiefly occurs on the fire side and appears t[o] be from a fatigue action. This action can result fro[m] fluctuations of heat input and especially when violen[t] change occurs as when pulling a grade with an oil bur[n]ing locomotive and then drifting on the reverse side wi[th] little heat input to the box.

A complex form of failure has been recognized by th[e] Research Laboratory of the International Nickel Com[pany]. This involves the inclusion in the crack of pro[d]ucts of corrosion which act in a wedging manner [to] propagate the crack. Considerable data exists to su[b]stantiate this theory.

Ray McBrian, engineer of standards and researc[h] D. & R. G. W., lays great emphasis upon the decarbu[r]ized surface of the plate as providing nuclei for fatig[ue] cracks. His views are impressive and find much in th[e] theory of fatigue to support them.

Undoubtedly any steel can be induced to fail in a fi[re] box. It requires patient and time consuming study [to] alter firing conditions to prevent failures. When su[ch] studies are made they amply reward the road. Of[ten] one item of draft control or burner manipulation w[ill] provide a longer life for side sheets.

Staybolts appear to be a necessary feature of engi[ne] construction. Decades of study have failed to find [a] good substitute for these pieces of equipment. Evol[u]tion of materials have led to the widespread use of nick[el] irons and steels[9] in a large number of installations.

Locomotive Parts

The 2¾ per cent nickel steels[4] have been widely us[ed] as forged and heat treated side rods (Table II). Th[e] record of performance has been good. This mater[ial] also finds use as the highly stressed main pin, also [for] piston rods, driving axles and many other uses.

Table IV—Cast Low-Carbon Nickel-Vanadium Steel

(Representative properties on test coupons treated with castings)

Type treatment: 1700 deg. to 1850 deg. F., air cooled; 1500 deg. to 1550 deg. F., air cooled; drawn 900 deg. to 1200 deg. F.

Composition, per cent C	Mn	Ni	V	Yield point, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elong. in 2 in, per cent	Red area per cent
0.18	0.62	1.44	0.09	58,500	78,500	26.0	47
0.19	0.64	1.62	0.10	57,000	83,500	27.0	52
0.20	0.73	1.60	0.08	64,000	84,000	30.0	63
0.23	0.60	1.54	0.11	60,000	81,000	29.0	54
0.25	0.62	1.45	0.10	61,000	80,000	28.5	55

Table V—Cast Medium Carbon Nickel-Vanadium Steel

(Representative properties on test coupons treated with castings)

Type treatment: 1700 deg. to 1850 deg. F., air cooled; 1500 deg. to 1550 deg. F., air cooled; drawn 900 deg. to 1200 deg. F.

Composition, per cent C	Mn	Ni	V	Yield point, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elong. in 2 in., per cent	Red. area, per cent	Izod imp. ft.-lb.
0.30	0.81	1.52	0.11	66,200	96,000	27.5	55.0	56
0.28	0.89	1.66	0.10	65,400	95,000	28.5	57.5	60
0.26	0.97	1.54	0.11	60,500	90,000	25.5	51.0	47
0.28	0.91	1.62	0.12	64,000	94,000	27.0	55.0	57
0.32	0.97	1.60	0.11	70,500	96,800	28.0	60.0	59

A nickel-chromium-molybdenum steel containing ap-
roximately 0.35/0.40 carbon; 1.5/1.75 per cent nickel; 65/0.75 chromium; 0.20/0.30 molybdenum was being creasingly used for side and main rods; also piston ds, before present restrictions on the use of alloys.

The desire of some roads for a higher strength side d material than obtained from the 2¾ per cent nickel eel that would not require a quenching operation led the use of a 0.25-0.35 carbon; 2.50-3.00 nickel; 0.20 0.40 molybdenum steel[5]. This steel apparently has nply proved its worth.

The low-carbon nickel steel casting possesses a desir-le degree of ductility and toughness combined with gh order of strength. These features have dictated the e of this alloy for frames and other parts. When operly heat treated, the 0.20 carbon, 2 to 2½ per cent ckel steel castings possess excellent impact values at b-zero temperatures. This feature has encouraged the e of this nickel alloy for truck of Diesels and some pes of cars.

Nickel-vanadium steel castings also have been quite pular (Tables III; IV; V). This alloy contains about ½ per cent nickel with 0.10 per cent vanadium. The rbon maximum is set at about 0.30 per cent. The low rbon of this alloy and of the 2 to 2½ per cent nickel st steel renders them readily weldable, which will prove increasing importance.

Diesel locomotives that are appearing in increasing mber on railroads today and even under present re-ictions make use of many nickel steels. These steels m such parts as crank shafts, connecting rods, cam-fts, valves and highly stressed bolts.

Nickel in Car Construction

For passenger cars the 1.40 nickel, 1.40 manganese t steels have proven most popular (Table VI). This oy with 0.30 carbon has good impact and other mechanical properties. The use of 17 per cent chromium, 7 per cent nickel alloys in the construction of cars lead to lighter weight and sturdier construction than otherwise obtainable. The gleaming beauty of this alloy enhances the appearance of the equipment. Following the war there will be a widespread use of this stainless alloy, it is predicted.

Corrosion is a factor in the life of coal cars and tests with low alloy nickel steels and nickel-copper high strength steels are pointing a way to longer life from the conventional car. Use of these weldable alloys also indicates means of lightening the weight of freight cars in general. Nickel increases the tolerances of copper in steel and reduced hot shortness. Corrosion resistance and mechanical properties of the copper steels are enhanced by the presence of the nickel.

Nickel Cast Iron; Monel

Nickel containing cast irons have long played an important part in the make up of locomotives (Table VII). They will be found in such parts as cylinders, cylinder liners, pistons, rings and grate bars. The development of the Canadian Pacific with grate bars has been an important contribution to railroading. It is hoped the very hard Ni-Hard cast iron will make a contribution to resistance to cinder cutting. Tests are under way.

The 69 per cent nickel, 29 per cent copper alloys with the variations in composition that make up the various grades of Monel have been widely used in the railroad fields.

Monel pump rods have long been known in locomotive circles and the results to date justify the choice of this material.

Before the war, the abrasion resistance of Monel had led to its use as shrouds under some streamlined cars. This application will undoubtedly have wider scope in the post war era.

Monel staybolts have made an excellent showing in some of the locomotives of England and the continent. Tests of Monel bolts are under way on a prominent railroad of the eastern part of the States.

In washrooms and galleys Monel and the nickel containing stainless steels share honors in maintaining pleasing appearances and sanitary conditions.

Conclusion

The foregoing has been an attempt to depict some important uses of nickel containing alloys on railroads. The forward strides expected from the railroads of the post war era will undoubtedly make heavier demands upon these alloys that have already contributed so much to the present advance.

Table VI—Cast Nickel-Manganese Steel

(Representative properties on test coupons treated with castings)

Type treatment: 1500 deg. to 1550 deg. F. air cooled; drawn 950 deg. to 1200 deg. F.

Compositions, per cent			Yield point, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elong. in 2 in. per cent	Red. area, per cent	Izod impact, ft.-lb.
C	Mn	Ni					
[illegible]	1.48	1.43	62,800	91,400	28.5	63.5	45
[illegible]	1.60	1.41	68,400	101,700	26.5	59.5	65
[illegible]	1.62	1.43	69,800	96,500	27.0	57.0	63
[illegible]	1.44	1.57	65,400	94,500	28.0	55.0	
[illegible]	1.41	1.40	61,000	99,200	24.5	57.5	41

Table VII—Applications of Alloy Cast Iron in Locomotives

plication	Typical compositions used, per cent: Total carbon	Silicon	Manganese	Nickel	Chromium
inders	3.10	1.10	0.90	1.10	0.40 Max.
inder bushings, piston bull rings, packing rings, piston valve rings and followers	3.10	1.50	0.70	1.20	0.40 Max.
e valve bodies and bushings	3.20	1.50	0.70	1.10	..
head gibs, grinders, blocks and shoes	3.20	1.30	0.80	1.00	0.30
te bars	3.20	1.20	0.80	1.50	0.60

Bibliography

—Alloy Steels in Boilers, by A. B. Trumbull, chief mechanical engi-r, Mechanical Advisory Committee, C. & O., *Railway Mechanical ineer*, Feb., 1943.

—Testing Locomotive Axles, by Dr. O. J. Horger, research engineer, ken Roller Bearing Co., *Railway Mechanical Engineer*, October, 1938.

—Recom. R.R. Spec. No. 3, latest Rev., The International Nickel Co., Wall Street, N. Y. C.

—Recom. R.R. Spec. No 2, latest Rev., The International Nickel Co., Wall Street, N. Y. C. Also A.A.R. Spec. M-104-(c).

—Recom. R.R. Spec. No. 13, latest Rev., The International Nickel Co., Wall Street, N. Y. C.

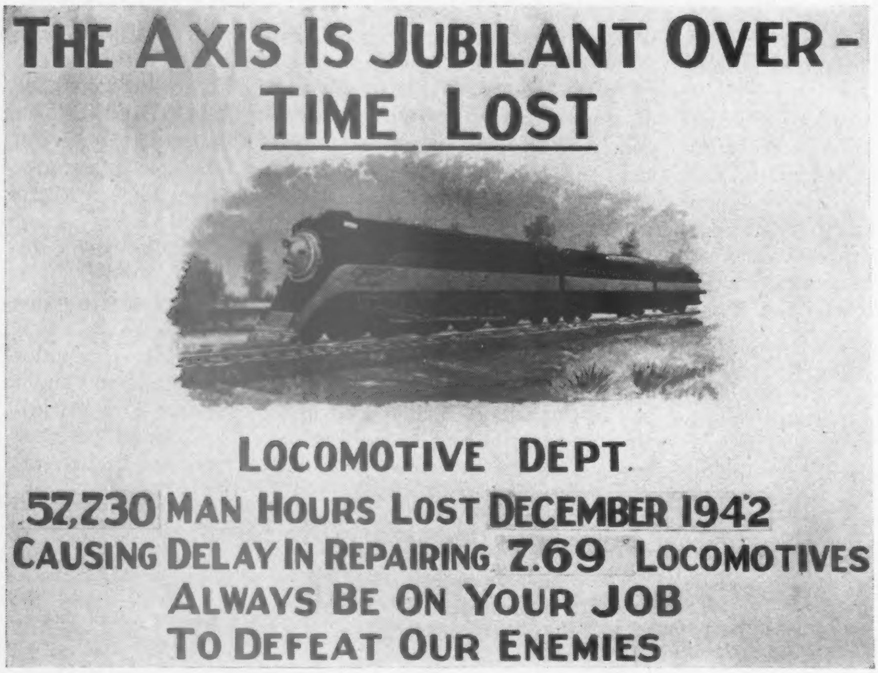
—Recom. R.R. Spec. No. 8, latest Rev., The International Nickel Co., Wall Street, N. Y. C. Covers "Low Carbon Nickel Steel Main Frames Locomotives."

—Recom. R.R. Spec. No. 4, latest Rev., The International Nickel Co., Wall Street, N. Y. C. Covers "Low Carbon Steel Casting for Loco-ives and Cars."

—Recom. R.R. Spec. No. 3, latest Rev., The International Nickel Co., Wall Street, N. Y. C.

—Recom. R.R. Spec. No. 7, latest Rev., The International Nickel Co., Wall Street, N. Y. C.

ROUNDTABLE on A



Posters used in the locomotive department of the repair shops of the Southern Pacific Company at Sacramento, Calif.—The same practice is followed in the passenger and freight car departments

In the March issue our readers were invited to join in a roundtable discussion of the problem of absenteeism. "How can we reduce absenteeism to a very minimum?" What practical suggestions have you to offer?" we asked. The comments received which appear on this and the adjoining page cover a lot of ground and contain many useful suggestions. See page 172 for the announcement of the subject of next month's discussion.—Editor.

Emphasize Safety

Safety should be emphasized. Rules and practices have been inaugurated and the importance of living up to these rules should be stressed to each employee, in order to prevent accidents and a resultant loss of time, which are costly to the company and retard the war effort. Good housekeeping—properly ventilated and heated shops—promotes safety and better health, which results in a reduction in absenteeism.—*R. V. Blocker, Superintendent Motive Power, Erie.*

Victory Committee Uses Posters Effectively

Everyone is absenteeism-conscious these days and the Southern Pacific Company, like many other railroads and industries, is trying to find a workable plan to minimize this waste of man-power.

It is evident that the old adage, "You can lead a horse to water, but you cannot make him drink," applies here. Barring compulsion laws, our plan must find in some way an incentive to make men and women want to work. Paradoxically, the war does not seem to produce that incentive.

Leaving discipline—which is used only in exceptional cases—out of the picture, we have resorted principally to the poster plan, with slogans covering every conceivable inspiring, encouraging, and shaming subtlety of words and pictures our ingenuity could produce, to stimulate this "want to work urge."

This poster plan was inspired and is supervised by a Victory Committee representing both labor and management. The most effective of the posters were ones showing actual losses in reduced output of locomotives, passenger cars and freight cars. The photographs clearly indicate this type of poster. The number of lost man-hours is indicated each month, together with the equivalent in units of production. A removable tag is made for each item, changed each month, to facilitate current posting.

At Sacramento general shops, our largest, for example, three of these posters are used for locomotive, passenger car a[nd] freight car shops, one at the respecti[ve] "check-in" stations and the other two [at] points in shops where they can be readi[ly] viewed. The results obtained since [the] month of December, 1942, when this ty[pe] of poster was adopted, is reflected in [the] table.—*A. B. Wilson, Superintendent M[o]tive Power, Southern Pacific, Sacrament[o,] Calif.*

Importance of Supervision

Some of the main reasons for absenteeis[m] on our railroad at the present time ar[e]: Public health, Lack of proper housing f[a]cilities, Inadequate transportation, Exce[s]sive overtime due to manpower shortag[e], Mental and physical tension as a result [of] war conditions, Lack of prompt medic[al] attention and first aid treatment.

Intelligent, sympathetic, understandin[g] supervision is still the largest single fact[or] in reducing absenteeism to a very mini[]mum. Supervision has, of course, little [or] no control over the first three items men[]tioned, but can do much in connection wi[th] the last three.

In many cases overtime can be mo[re] evenly distributed among employees. S[u]pervisors can demonstrate their leadersh[ip] by more intelligent planning and scheduli[ng] of work; by adopting a sympathetic att[i]tude toward the problems of the men und[er] their supervision; by appealing to the patr[i]otic spirit of every employee under the[ir] jurisdiction; by doing their utmost to ke[ep] calm and cool; and by executing the[ir] duties in an orderly manner.—*H. J. Schi[]thess, Chief of Personnel, Denver & R[io] Grande Western.*

Use Safety Campaign Metho[d]

The majority of the employees of the rai[l]roads have someone who is very close [to] them in the armed services, be it brothe[r,] son, daughter or others. I believe t[he] seriousness of the safety of those close [to] us in the armed services—in relation to lo[st] man-hours—can best be emphasized throu[gh] the use of the safety organizations of t[he] railroads or by similar methods. Poste[rs,] bulletins and pep talks, such as used [for] safety first, should be used. Establish [a] competitive spirit among the different d[e]partments of each road and between all [of] the railroads, as is the safety first mov[e]ment.—*C. L. Lehnis, Enginehouse Forema[n,] Chesapeake & Ohio, Handley, W. Va.*

Bulletin Posted at Sacramento Shops of the Southern Pacific

	Number men emp.	No. man-hours lost acct. absenteeism: Loco. dept.	Pass. car	Freight car	Equivalent unit loss in output: Loco. dept.	Pass. car	Freig[ht] car
Dec., 1942	3473	57730	4580	9340	7.69	3.67	51.89
Jan., 1943	3451	37800	3080	7520	5.04	2.47	40.67

ABSENTEEISM

ppeal to the Emotions

have thought this question over for some me and believe that for the time being, least, one should appeal to the emotions employees—that is to say, impress upon em that they are serving the enemies of e country when they unnecessarily lay off om work.

A certain coal mine operator attempted solve this problem by erecting a card-ard replica of Hitler giving the Nazi lute with one hand, and extending the her hand in greeting. When any one of e employees absented himself from work ithout sufficient cause, he was obliged, hen he returned to work, to procure his gistration and time card for that day om a hook, suitably attached to Mr. Hit-r's outstretched hand.

This may not be a very good suggestion offer, so far as railroad men are con-erned, although it did, according to the mor, serve as a remedy for absenteeism mong the coal miners in this particular ase. However, my suggestion is that some pproach of that kind might be more suc-essful in solving the problem than resort-g to the usual method of applying penal-es to absentees.—*K. Berg, Superintendent lotive Power, Pittsburgh & Lake Erie.*

Bonus for Perfect Attendance?

t seems as though some kind of a "bonus" or a perfect attendance record would turn he trick. You may remember that when e went to school some teachers were een on a perfect attendance showing and ould bulletin the record on the black-oard in an effort to keep it on the minds f the students. At the end of the month eacher would, if we had a perfect record, ive us some reward—possibly a treat or couple of hours of rest while she read a rilling story. Everybody tried to keep he laggard in line so the record would not uffer. How about a cup of coffee and a inker about three p.m.? It would renew he energy and would keep a man on his eet until he reached home. Some men ave to ride for two hours before they an put their feet under the table.—*From a Western Railroader.*

Dramatize by Posters and Publicity

Consideration of absenteeism and its effect on the war effort leads me to believe that some publicity and special study of this subject are imperative. Two types of pub-licity suggest themselves:

First, the use of bulletins or posters at shops and terminals. In this connection I think it would be well to consider the most effective type of poster, the experience of those who have resorted to this practice, the reaction of the men to the posters, and the possibility of intensifying interest by soliciting poster designs from amateur artists, who are found in a great many rail-road organizations.

The second type of publicity which sug-gests itself is that relating to or equating the man-hour day to the war effort. In other words, how many tons of freight or war materials would be just a mile farther from its destination due to the absenteeism from work of a man for one day in this critical emergency? What the total daily man-days lost through absenteeism on the Class I roads would mean in delays to military supplies—and other such pertinent equations, which would tend to emphasize to the country in general the seriousness of the absenteeism problem.—*F. K. Mitchell, Assistant General Superintendent Motive Power and Rolling Stock, New York Central System.*

Several Worthwhile Suggestions

We have constantly kept the seriousness of absenteeism before our employees with strikingly appropriate posters, conveniently located in all shops, so they will be ob-served by the greatest number of employees frequently. We have had the hearty co-operation of our shop crafts committees in keeping the matter before our men; and our supervision has also talked to our men in groups, especially when safety meetings are held, discussing absenteeism as well as increased output. We believe we have ob-tained a reasonable response to our appeals.

We have recently arranged to handle cases of absenteeism individually where the habitual time-loser is concerned. At times they are interviewed by both the ranking mechanical officer at the terminal, as well as the chairman of the local committee; in this way we only talk to the men actually involved in losing time.

It might be well to give more publicity to the individual who has worked regularly, including Sundays, and possibly overtime. This might arouse the interest of the fellow who is losing time unnecessarily.—*Mechanical Department Officer.*

* * *

John F. Noon, precision grinder set-up man and winner of a weekly slogan contest of employees of the Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

How to Reduce to a Minimum

My suggestions as to how absenteeism can be reduced to a very minimum are as fol-lows:

1—Appeal to the patriotism of each indi-vidual.

2—Avoid Sunday work as far as prac-tical, or confine the work to six days per week.

3—The most effective means will be when our wounded boys return from the battle fronts by trainloads. The men will then realize the seriousness of this war and will be anxious to do their part.—*K. F. Nystrom, Mechanical Assistant to Chief Operating Officer, C. M. St. P. & P.*

"We've Got to Lick the Enemy"

The average worker does not see that his absence for a day now and then can really amount to anything. The war has not yet hit close enough home. Nor does he recog-nize the cumulative effects of many men remaining away from work. The average man needs an incentive to cause him to put forth extra effort. How are we going to produce this incentive? Some industrial concerns have gone so far as to enclose with every pay check a slip stating, "You lost —— days from work this pay. Every day lost is a contribution to the Axis."

We would like to offer the suggestion that management take labor into its con-fidence more, make the workmen feel they are participating in a real and important job. Pep talks may be hooted at by some, but they are a very real stimulus when properly used.

Men take pride in what they are doing if they are made to feel that their jobs are important. Can't we appeal to the spirit and courage that is in every man, can't we make him see that his job is vital, no mat-ter how lowly?

Men will work if they have an incentive. The incentive is present, but it hasn't been brought home to the rank-and-file. In ad-dition to its other duties, it is now up to management to assume the role of a good football coach and say, regularly, "You're doing a good job, men, but we've got to lick the enemy, so get in there and fight!" —*S. W. Selden Mechanical Department, R. F. & P.*

EDITORIALS

Tell Us Again!

The past year has witnessed one of the most remarkable performances in the history of railroading. The roads succeeded in handling the largest volume of traffic in their history only because they pressed into active service a higher percentage of their locomotives than ever before. But still more must be accomplished and the problem is how to do it. Studies made by individual railroads indicate that a locomotive is in the hands of the mechanical department, at terminals, from four to eight out of every 24 hours of the day. The problem is *How can the time of locomotives at engine terminals be reduced?* Can improvements in inspection methods, servicing methods, or repair methods help to reduce terminal time? What improved facilities would help in this respect? Your answers to these questions will constitute our roundtable in the May issue. Your letter must be in our New York office not later than April 16.

How Mechanical Workers Are Trained on The Railways

Information has come to us from various sources that there is a misunderstanding on the part of some Selective Service Draft Boards as to the advisability of deferring skilled workers in the railway mechanical departments. The assumption on the part of some of these boards seems to be that since specialists can be quickly trained for certain types of production work in the manufacturing industries, it will be just as easy to quickly train men to maintain and repair railway cars and locomotives.

The railroads never have looked to the vocational or trade schools for such workers. It has been the practice to train them "on the job," either through thorough apprenticeship, or by the development of helpers who are employed to assist the mechanics.

Safety Paramount

Why has this "on the job" training of skilled workers in the mechanical department been considered so necessary? Safety is, of course, paramount in railroad operation. The mechanic must know when the job is completed that a locomotive is safe to despatch on its run; or that a freight car has been properly repaired; or that the safety appliances meet specifications; or that a car is loaded in accordance with A.A.R. rules; or that the loading is within the prescribed clearances for high and wide loads over the connecting lines to destination. It is true that foremen are available to advise and direct the workmen, but, on the other hand it is also true that the foremen cannot personally see and pass upon every job. Most of such responsibilities must be delegated to the workmen. In the case of a repaired car or locomotive even a loose bolt might be responsible for the derailment of the locomotive or train, with loss of life and heavy damage to property. That is why safety is of such vital importance in railway work.

Essentially Repairmen

While it is true that some new equipment is built in railroad repair shops and some parts for maintenance are manufactured, by far the majority of the workers are essentially repair men. Workers for assembly lines or for operating machines in production shops may be trained in short, concentrated instruction periods at vocational or trade schools. This, however, is not true of skilled railroad mechanics, and particularly those who work on repair operations, or in enginehouses or on the rip tracks. These workers, to a certain extent, must be able both to diagnose the trouble and to make the necessary repairs. To do this they must have an all-around knowledge of their trade and must understand the service requirements of the particular piece of equipment on which repairs are being made. They must not only understand the functioning of the particular part, but must also know its relationship to other machine or equipment parts.

Training "on the job" serves to develop judgment

in a workman, or a degree of discernment that makes it possible for him to decide whether a freight car should continue to destination or be sent to the shop track for repairs; or whether a locomotive with a leaky firebox should be continued on its run, or have the fire drawn and the leaks repaired. All these are questions of judgment. While it is true that the foremen usually take responsibility in matters of this sort, they cannot possibly follow through in detail all of the work performed by the mechanics, and greater reliance must therefore rest upon these employees than upon the industrial production workers.

It may be suggested that the problem is partly one of providing additional supervision, but under present circumstances this would simply make an additional drain upon the available skilled mechanics and would not serve to release additional men for other purposes.

Diversified Tasks

Women with no previous mechanical or practical training are today being trained for production work as welders in manufacturing plants. In contrast to this, the average welder in a railroad repair shop, instead of making one particular weld with the same rod, and with the same flux, and in the same position, day after day, is called upon for quite diversified jobs. Many of these welders must be qualified to make either acetylene or electric welds. For one hour a welder may be building up a wearing surface with a particular grade of bronze or steel; in the next hour he may be welding a fractured part, using either the electric or the acetylene process. Next he may be called upon to make a locomotive frame weld, either by the electric or acetylene process. He may finish up the day by being called upon to make an overhead electric weld in a locomotive firebox. It requires very little imagination to visualize the limitations of a "six weeks welder" in a railroad locomotive or car repair shop.

Under present conditions every possible effort must be made to train sufficient skilled mechanics to meet the unusual demand in the railroad shops, enginehouses and repair yards without resorting to "off the job" training methods. The task is being tackled in different ways in different places, and under widely varying conditions. Among some of the suggestions that have been offered to protect the situation are the following:

A Few Suggestions

1. Discontinue appointing regular apprentices (ages 16 to 21) for the duration and appoint helper apprentices, confining the selection to such employees as are married, with dependents, and are not immediately subject to the draft.
2. Continue employment of men eligible for retirement under the Railroad Retirement Act as long as they are physically able to work.
3. Negotiate agreements with the labor organizations that will permit upgrading helpers to mechanics.
4. Permit the appointment of helper apprentices that are over 30 years of age by relaxing the maximum age requirement.
5. Intensify the training of apprentices so that they may become skilled mechanics before the completion of their scheduled apprenticeship.

While trade and vocational schools can train men and women who are acceptable for employment in railroad shops in certain isolated cases of specialized work, they are no solution of the problem of replacing railroad mechanics inducted into the armed services.

Too Much Army May Lose the War

Wars inevitably involve taking great risks. This fact distinguishes the management of military affairs from the management of civilian affairs. In order that they may control the extent and danger of these risks as fully as possible, military leaders have usually received first call on men and material in time of war. This was the common-sense course to take when wars involved only a part of the resources of a nation.

Today the needs of our military establishments have been multiplied many times since the first world war. A bewildering variety of mechanized tools for offense has led to the creation of a corresponding variety of specialized tools of defense. Even in the matter of clothing many new types have been developed to meet a great variety of field conditions.

But that is not all. There is lend-lease, which must draw heavily upon our resources of foods, industrial materials and manpower if the military efforts of the United Nations that are directly in contact with the Axis powers are to be kept effective. Then there is the problem of saving the starving populations overrun by the Axis powers which is expected to increase heavily the draft on our food resources somewhat in proportion to the military success of the United Nations' forces. To meet all of these urgent necessities requires the mobilization of the activities of every adult person and some of our children. With normal activities reduced practically to a subsistence level there remains little to distinguish civilian from military in point of importance to the successful prosecution of the war.

This is a situation, the control of which is beyond the competence of our military leadership, because it calls for the exercise of broader knowledge and understanding than training for military leadership can be expected to impart.

Up to a point, no doubt, the faster our armed forces are built up and the greater their ultimate number, the sooner and surer will be our victory. But to go so far in insistence on the last ounce of energy in this direction as to impair the capacity of the transportation system at home is trading a military risk of uncertain magnitude for one at home the effect of which can be evaluated with far greater certainty—a general slowing

down of the entire program of production and distribution which, in turn, will reduce the size of the armed forces which can be employed effectively at any given time.

There seems little doubt but that our military leaders are aware of the importance of transportation to the effectiveness of the nation's military operations. But there is grave doubt whether they are aware of, or are competent to interpret, the facts which point to the end of reserve capacity to cope with the prospective load on our railways. During the first 11 weeks of 1943, carloadings, excluding merchandise less car load, increased three per cent over last year. The increases were principally in coal and grain loadings. Henry F. McCarthy, director of the Division of Traffic Movement, ODT, in an address before the New England Shippers' Advisory Board on March 18, declared that the increase in turn-around time has in effect reduced the box car supply by 4.2 per cent and the open-top car supply by 6.8 per cent as compared with last summer.

Joseph B. Eastman has warned that it may soon be necessary to resort to a system of transportation priorities to protect so-called essential war transportation. Should that be done, then there has already been a serious failure of transportation. When materials and labor are as badly needed as at present, it is little short of criminal to waste them in production made ineffective by lack of opportunity for distribution. Furthermore, as our production of materials other than those directly involved in the conduct of the war approaches subsistence level, the application of transportation priorities will impair the morale and slow down the tempo of war activities.

Warnings have been sounded, both in and out of Washington, of the need for more motive power and freight cars, for more materials and manpower. Unless the seriousness of these warnings is grasped and they are acted upon the United States can be defeated by the grandiose proportions of its military plans.

Has the Need For Progress Ceased?

Within the past month a meeting of officers representing the coordinated mechanical associations (Boilermakers, Car Department Officers, Railway Fuel and Traveling Engineers, and Locomotive Maintenance Officers') was held at Chicago to consider the problems with which these associations are faced under the difficult conditions of the present time and to develop the policies under which they will operate for the duration. At that meeting the first three of the above groups voted to continue operation on much the same basis as has prevailed during the past year; namely, to forego the holding of a convention or exhibit but to continue the work of the various technical and business committees and to make the reports of the committees available to their members and the industry generally through publication in their annual proceedings or in trade journals, such as the *Railway Mechanical Engineer,* or in some cases, by both means.

It is with concern that we learn that the Locomotive Maintenance Officers' Association notified the co-ordinated associations group at the Chicago meeting that it had decided to suspend all of the association's activities, including the collection of dues, for the duration. If we are correctly informed, the reason why this action was taken was because its members are so completely engaged in their work on the railroads that they have no time to devote to association work.

It has long been our belief that in times of great national emergency, such as we are now going through, a democracy, while slower in getting started toward an objective that may contribute to ultimate victory proceeds with great rapidity, once started. Its people not only are encouraged to work together toward a common end, but they know from three centuries of expeirence that widespread trading of ideas will assure that a group, or a people, will make progress in direct proportion to the extent to which that idea is carried out. The same basic philosophy applies to any organization, the objectives of which are to promote progress within a group, an industry, or even a nation. We have never felt that any justification was needed for the continued existence and activity of any organization functioning in such a manner that its membership was aided by its work.

We can not help but wonder if the officers of the Locomotive Maintenance Officers' Association were fully conscious of the significance of their decision. Is there no need for the work of such groups as this and is it true that its members might more profitably devote their time and energies only to their daily tasks? If that is the case, then the many national technical societies such as the mechanical, civil, electrical, chemical and metallurgical groups, that are now contributing so richly to the war effort are wasting hundreds of thousands of man-hours—mostly overtime man-hours, too—that might more profitably be directed into — what?

These questions are not asked in a spirit of criticism. They are asked because the editors of this publication have a firm conviction that the work of the Locomotive Maintenance Officers' Association is needed more in 1943 than it has been needed in the past.

In all fairness to the association's officers it may be said that the absence of positive encouragement on the part of many chief mechanical officers may have been interpreted as an indication that the results of this association's efforts have not been such as to justify its continued support on the part of the railroads. If there are those who feel that way, the best interests of the mechanical department will be served by a frank and open discussion of this subject, for they can ill afford to give acquiescence, by silence, to a suggestion that there is no time to be spared in an effort to improve locomotive maintenance facilities and methods. That is what the suspension of this association's activities suggests.

With the Car Foremen and Inspectors

Car Repairs in The Anthracite Region

The substitution of wood for steel in the repair of open-top cars has created no problem for the working forces at the Carbondale, Pa., repair tracks of the Delaware & Hudson when cars of composite construction require attention. These tracks are located near the source of

After painting this repaired composite type car will move to a nearby colliery to load anthracite

much of the anthracite which the road carries. Most of the work performed on cars is light in nature but some repairs are made to open-top cars, particularly those of the composite type which the company is continuing in the coal trade. This work is performed under a modified spot system. Cars are stripped to the extent necessary and are then rebuilt using both new and reclaimed materials. Generally the work consists of straightening posts, braces, top chord angles and side sills, and renewing side planking, wooden slopes and doors. Extensive use is made of reclaimed materials and good sections of removed planking are used in light repair work.

Material handling and repairs are expedited by the use of a gasoline crane truck operated over concrete runways

Material handling is expedited by the use of a gasoline crane truck equipped with a telescopic boom. Operations are greatly facilitated by the provision of concrete runways along the repair tracks which are of especial value in inclement weather.

An Effective Wood Saw Guard

Although woodworking is one of the most hazardous operations in industry, the mill room of the Pullman car repair shops at Calumet (Chicago), Ill., has had a perfect safety record for nearly 14 years. In all of these years not a single lost-time injury has been incurred in this department, according to Harry Guilbert, safety director of the Pullman Company, who attributes the record to "painstaking employment of every possible human and mechanical precaution." The significance of this performance is emphasized by the fact that the woodworking industry, in 1941 for example, had an accident rate of 22.4 per million man-hours of work, or nearly one-third higher than the overall rate of industry.

The illustration shows Mr. Guilbert inspecting a new safety guard developed by George Gibson (left), foreman of the mill room. Said to be the only device of its kind in the country, the guard is adjustable, so that it may be dropped down to shield whichever of the two saw blades is being used. The blades are both turned up to cutting position for purposes of illustration, but in actual service only the blade being used is above the surface of the table.

The new guard not only protects the operator against the cutting teeth of the saw blade itself, but eliminates the great woodworking hazard of "kick-back." In unprotected operations, the teeth of the saw may dig into the work which is being withdrawn by the operator and hurl it forwırd with the velocity of a projectile. An unguarded blade may cause the loss of a finger, but "kick-back" often results in death.

Referring to the illustration this general construction of this saw guard is readily apparent. It consists of a steel guide block *S*, rigidly supported and braced about 4½ ft. above the saw table and having a horizontal hole large enough to accumulate a closely fitting piece of 2½-in. pipe *H* which has a pipe cap threaded on the right end and is beveled and securely welded on the left end to a longer vertical section of 2½-in. pipe *P*. Pipe *P* is grooved at the bottom to receive a key which fits a corresponding slot in block *S* and prevents pipe *H* from turning. By lubricating the smoothly-finished pipe *P*

lightly, however, it is free to move horizontally, being locked in either extreme position (with the guard covering a saw) by a pin through block S and the pipe P.

The saw guard G, made of sheet metal of the shape shown, is welded to a short section of 2-in. pipe which telescopes inside pipe P and is supported by a wire cable extending up to a small pulley wheel and thence downward to a counterweight which moves up and down in

A saw safety guard used at the Calumet car repair shops of the Pullman Company

guide pipe W, lightly welded to the side of pipe P. This counter-weight is just heavy enough to permit the saw guard to move downward by its own weight and rest lightly on the saw table. Saw guard G is prevented from swinging by the pin through block S and pipe H. It is held parallel with the saw by a spline on the 2-in. telescoping pipe which engages a narrow groove cut in the back of pipe P, as shown in the illustration. The saw guard can be locked in the raised position by a hand knob and holding screw, also illustrated, when it is necessary to see the saw in making adjustments for varying widths of lumber to be ripped or cut off.

In operation, a piece of lumber is pushed through the saw, easily raising the guard on entrance and permitting it to drop over the saw again at completion of the cut. In case the piece of lumber cut off has to be pulled back past the saw, the guard prevents any possibility of contact with the rapidly revolving saw teeth.

In 1942 the Pullman Company had a perfect safety record in its shops throughout the country. In 7,000,000 man-hours, embracing almost every type of industrial occupation, there were no lost-time injuries, one of the few times such a mark has been achieved in a major industry.

Safe Handling Of Leaky Tank Cars*

The acute shortage of petroleum products in certain sections of the country has made it imperative that during the emergency every available tank car should be placed in this type of service in an effort to relieve the situation.

An investigation of some of the delays to loaded tank cars show that many loads of inflammable liquids are being transferred due to slight leaks or seepages of tanks which could be moved to destination without any appreciable hazard or loss of contents.

To assist those directly connected with handling such defective tank cars, the following suggestions are offered with the idea of facilitating movement of this type of equipment with a minimum of delay.

Safety Precautions

If a car tank is leaking more than 30 drops per min. at any one location, which leak cannot be stopped by methods given below, then the car should be moved away from all open flames, fires, switch lamps, etc. The tank should then be relieved of all interior pressure by cooling with water or venting the tank by raising the safety valve on the dome at short intervals. If venting to relieve pressure will cause a dangerous amount of vapor to collect outside the car, venting must be deferred until pressure is reduced either by cooling with water or by allowing the car to stand a sufficient length of time.

If the dome cover is removed for the purpose of determining whether the outlet valve is seated, the following instructions must be followed:

(*a*) *Screw type dome cover*—The cover must be loosened by placing a bar between the manhole cover lug and knob. The bar should be covered with rags or burlap to avoid sparking. After two complete turns, so that the vent openings in the cover are exposed, the operation should be stopped, and if there is any sound of escaping vapor, the cover must be again screwed down tightly and the interior pressure relieved as prescribed above before again attempting to remove the cover.

(*b*) *Hinged and bolted type*—All nuts must be unscrewed one complete turn, after which the same precautions as outlined above must be followed before attempting to remove the cover.

(*c*) *Interior type*—All dirt and cinders must be carefully removed from around the cover before the yoke is unscrewed. (Failure of the interior cover to drop from the seat is an indication of interior pressure which must first be relieved before again attempting to open the cover.) It is well to point out that the hinged and bolted type, as well as the interior-type covers, may have gaskets frozen on their seats necessitating slight tapping to loosen them. A piece of wood or a wood mallet should be used for this purpose. *Never use a metal tool which will throw off sparks.*

Any inflammable liquid found on the ground should be covered immediately with fresh dry sand, dirt or cinders.

Tanks with Cracked Sheets or Leaking at Rivet

Tanks leaking due to cracked sheets are a definite hazard and the lading should be transferred. While a crack may be small at the time of inspection, further movement of the car may cause the crack to progress with the result that the entire load may be lost.

* Circular letter to members and private tank car owners, issued by the A.A.R. Mechanical division under date of March 2.

Tanks leaking at seams or rivets over 30 drops per min. at any location are a hazard. If such leakage can be reduced to 30 drops per min. or less by making temporary repairs, the car should be allowed to proceed. If unable to reduce this leakage to 30 drops per min. or less, then the contents should be transferred and the tank properly repaired before being returned to service.

Tanks leaking over 30 drops per min. can be given temporary repairs in many cases that will eliminate the necessity for transferring contents. Leakage at seams or rivets can be eliminated or reduced, in most cases, by the use of various caulking compounds. Ordinary yellow laundry soap has been used with good results in stopping leaks at seams or rivets where the car has only a short distance to travel. Another method is to force fine lead wire into the seams at the points of leakage. All of these caulking operations should be performed with a wood mallet and a sharp pointed hard wood stick. *Never use a metal tool which will throw off sparks.*

Tanks Leaking at Outlet Cap

Leakage at the outlet cap may be due to several causes. Possibly the outlet cap is loose or the basket is defective and leakage is due to the accumulation of liquid inside the outlet casting, caused by the outlet valve not being properly seated, or the seat of the outlet valve slightly worn.

In such cases where the leakage is greater than 30 drops per min., the attempt should be made to stop the leak by tightening the outlet cap with a wrench at least 48 in. long. If this does not stop the leak, it may be that the basket is defective or missing; in which event it then becomes necessary to remove the dome cover (see instructions under safety precautions) to see if the valve is in the closed position. This can be done by operating the valve-rod handle or wheel a few times. If the valve is found to be closed, replace the dome cover and remove the outlet cap very slowly. If the flow of liquid comes in force it indicates that the valve is not in the closed position and therefore the lading should be transferred.

If loosening the outlet cap indicates that there is a slight leakage through the outlet valve, it may then be possible to stop the leak by removing the cap and applying a new gasket.

When removing valve caps, keep a pail under the outlet leg to catch the contents to avoid spreading.

Tanks Leaking at Tank Head Plugs

If the plug is applied from outside the tank head, then attempt to eliminate or reduce the leak by tightening the pipe plug. If this tightening does not reduce leakage to 30 drops per min. or less, then the contents must be transferred.

If the tank plug is applied from inside the tank and leakage exceeds 30 drops per min., then the contents must be transferred.

Tanks Leaking at Heater Coils

Any leaks at heater pipe caps or at threaded joints of inlet or outlet nipples indicate that the coils inside the tank car are defective. Such leaks outside of the tank may be eliminated or reduced to 30 drops per min. or less by tightening the coil caps and nipples.

In cases where loaded tanks have been given temporary repairs and allowed to proceed to destination, the tank must be stencilled "Leaky Tank" and an "X" placed at the points of leakage. The car owner should be immediately notified by telegram that the car has been allowed to proceed to destination with temporary repairs and must be inspected and properly repaired before it is again loaded.

Air Brake Cut-Out Cocks Closed

There have been numerous delays to tank cars due to the fact that air brakes have been cut out where no defect in the brake equipment existed, causing unnecessary shopping and delay. In tracing to find the cause for closing the cut-out valve, it has been found that employees at loading and unloading racks have closed the valve handle when removing or applying the outlet valve cap on account of alleged interference of this handle with the removal of the cap. After their work has been finished, they have failed to open the cut-out cock.

It is very important that workmen at the loading or unloading racks be instructed never to open or close the cut-out valve, nor to interfere with any portion of the air brakes on the cars while they are loading or unloading tank cars. Instructions should be issued to the proper parties so that delays due to this cause will be avoided in the future.

Better Tools Needed for Car Repairs*

By F. G. Moody

There is good and sufficient reason for predicting that the number and percentage of bad order cars will gradually increase, unless car repair facilities and methods are improved to the extent necessary to compensate for shortage of material and labor.

We are fully cognizant of the fact that no attempt should be made at this time to modernize car repair plants completely by replacing old and obsolete heavy machine tools, but I dare say there are few, if any, of our larger shops and repair tracks which are not sorely in need of additional small tools, such as high-speed jacks, welding machines, rivet forges, riveting hammers, air motors, motor hoists, and numerous other small tools. Wholesale placement of orders for these items is not suggested, as it is believed careful study will show that a relatively small quantity strategically located will suffice, but these are some of the items which should and must be provided to offset the shortage of labor and to expedite and increase output of repaired cars.

The more intensive utilization of all freight cars coupled with a very substantial decrease in the number of cars now receiving general repairs has already resulted in an increasing number being taken out of service account of bad order, and as there are still a large number of cars in service that are from twenty-five to thirty years old and which under normal conditions would have been taken out of general service long before this, it is reasonable to expect that as a result of overloading based on actual physical condition, greater mileage and higher speeds, they will become bad order at a more rapid rate than heretofore.

Under present conditions, these old worn out cars cannot be replaced or rebuilt in kind, but in their pres-

* Part of the discussion presented at a meeting of the Western Railway Club, held at the Hotel Sherman, Chicago, on Monday evening, March 15, 1943. The discussion, prepared by Mr. Moody who is superintendent of the car department, Northern Pacific, was presented by his assistant G. H. Wells.

ent advanced state of deterioration and obsolescence they require frequent repairs which result and will continue to result in an ever increasing number of cars marked bad order; therefore, to compensate in the fullest degree possible for shortage of labor and increased amount of work with which we are now confronted and which must be done, careful study and planning on the part of supervisors in an effort to obtain maximum use of existing facilities is of paramount importance. In many cases, much may be accomplished through slight re-arrangement of tools and facilities to obtain this. For example, the rapidly increasing number of wheel changes being found necessary calls for consideration being given to the question of improvements in storage and handling facilities, to lessen the labor of handling wheels at wheel shops and on repair tracks.

Mounted wheel storage tracks should be conveniently located in relation to service and repair tracks where wheels are changed. Suitable hoists or cranes should be provided for quick and efficient loading and unloading of mounted wheels and other heavy materials. At secondary and smaller repair tracks, simple hoists, transfer dollies, etc., which will greatly speed up the work and reduce labor required to change wheels, truck sides and truck bolsters can often be made from available scrap and obsolete materials.

As a means of preventing avoidable waste of man hours, adequate transportation should be provided. In many cases this can best be accomplished by furnishing company-owned automobiles and delivery type trucks for use of employees who are required to travel relatively long distances in the performance of their duties, especially at large terminals, and when called upon to make emergency repairs to cars at remote locations. Furnishing of such transportation will speed up the work and thereby insure delivery of cars to destination with minimum detention account of bad order, and also will insure prompt return of men to their home point.

Finding Leaks In Brake System

*By P. J. Hogan**

Freight cars are often set out of trains at points where no compressed air is available for the repairman to check the brake system before certifying the car as being fit to move after other necessary repairs have been completed. The following is an outline of a simple method which will give satisfactory results in determining whether the air-brake system is free from leaks. Use of it will eliminate the possibility of train delays caused by returning cars to service with faulty or broken piping. The operations are as follows:

1—Close the angle cock at one end of the car.

2—Kink the air hose by doubling it and placing the coupling head in a position to keep the hose kinked during the test. This will guard against loss of air from a leaking angle cock.

3—Open the auxiliary reservoir drain cock and keep it open during operation No. 4.

4—Open the angle cock on the opposite end of the car to that mentioned in operation No. 1. Then cover the air-hose gasket opening with your mouth, take a fairly deep breath and blow into the hose without allowing any breath to escape at the gasket. This will move the triple piston to the release position.

5—Close the auxiliary reservoir drain cock and make sure that it is well seated. This can be accomplished by shaking the drain cock handle.

6—Proceed as in operation No. 4 by blowing into the air hose. Hold your breath for about three seconds. If the pipes are tight, your breath will back up to your mouth. This will indicate that the system is tight and that no pipes are broken. A leak in the system is indicated if your breath moves away and does not return.

7—If the system is found to be leaking, close the cut out cock in the branch pipe and again proceed as in operation No. 4 by blowing into the air hose. This time if your breath returns to your mouth it indicates a tight brake pipe and is evidence that the leak is on the auxiliary side of the cut out cock. This calls for a close examination of the remaining portion of the brake-pipe branch, auxiliary reservoir and its drain cock. If your breath moves away slowly at the time of the test with the cut-out cock open, it is possible that the leakage is in the seat of the drain cock, or that the atmosphere is being compressed in the auxiliary reservoir through the feed groove.

8—Auxiliary reservoir leakage can be determined by blowing into the air hose a few times, holding your breath for about two seconds each time, then opening the auxiliary reservoir drain cock and while doing so listen carefully for escaping air. If the system is tight quite a pronounced puff of air will be heard. When making this test, if leakage develops, the leak can be heard by a second party if he listens carefully along the pipe line at the suspected area while the atmosphere is being compressed.

9—If the car undergoing the test is located at a point where the condition cannot be remedied, and the brake pipe is tight to the cut-out cock, it will be known that the car can be handled in a train, with the brake cut out, to a point where repairs can be made.

Operations Nos. 1 and 6 are the essential items in this test and require approximately two minutes time.

* Supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

164—*Q.—What provision is made to prevent release of the emergency application before the train comes to a stop?* A.—Quick-action chamber air of the vent valve is vented through choke *20* in piston *42*, and a second choke *67*, in adjacent cover, the chokes thus timing the release of the quick-action chamber air from passage *t-2* to a definite interval, after which a spring closes vent valve *40*. This insures the vent valve remaining open long enough to provide positive transmission of quick action, prevents the release of emergency applications prematurely and then closes the vent valve exhaust to allow recharge of the brakes.

165—*Q.—How does the brake equipment operate when operated by a steam locomotive in automatic service?* A.—This operation will be described later. The double check valve *228* (Fig. 17) is moved to its left-hand seat, closing off the straight-air pipe passage *8a* and establishes connection from the service port *3a* to the relay pipe *16*.

IN THE BACK SHOP AND ENGINEHOUSE

Setting and Maintaining

Flues Without Copper Ferrules*

Part II

By S. Christopherson†

Procedure for welding tubes in the sheets—Maintenance of welded tubes—Application of arch tubes

ALL holes in the back flue sheets for flues and tubes should have the inside and outside edges rounded to a radius of 1/16 in. to prevent cutting of the flue or tube. This is important when copper ferrules are not used and should be insisted upon to insure a good job. On an old sheet, when holes have become enlarged 3/16 in. above the nominal diameter of the flue hole, the sheet should be removed and scrapped. When using old sheets, when copper ferrules are eliminated, the 2-in. and 2¼-in. flues should not be swaged.

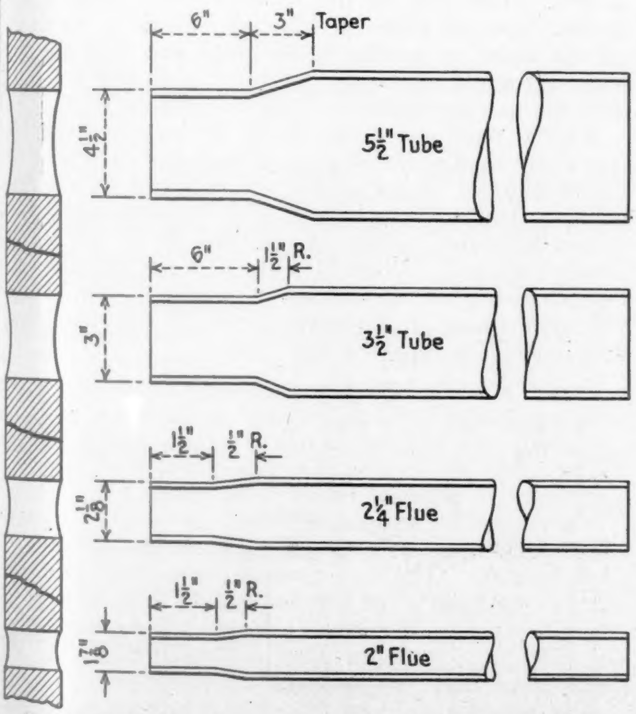


Fig. 6—Swaging practice for the back ends of tubes and flues

On old sheets, when copper ferrules are eliminated, the 3½-in. tubes should be swaged in accordance with the diameter of the hole found on each job. The same is true for the 5½-in. tube.

It is recommended that in this change of eliminating the copper ferrules new swaging dies be made for the new back flue-sheet holes and that the old swaging dies be bored to suit the old holes in the old sheets.

Holes for 2-in. and 2¼-in. flues should be 1/32 in. larger in diameter than the outside diameter of the flues. Holes for 3½-in. tubes should be 3/32 in. large, or 3 19/32 in. in diameter. Holes for 5½-in. flues should be 3/32 in. large, or 5 19/32 in. in diameter. All holes should have the inside and the outside edges rounded to a radius of 1/16 in. to prevent cutting of flues and tubes.

Flues and tubes should be tightened in the front flue sheet with a roller expander having flaring rolls. When holes have become over-size, the use of a galvanized-iron shim ⅝ in. wide is recommended. The shim should extend completely around the flues and tubes with the ends scarfed and lapped ½ in.

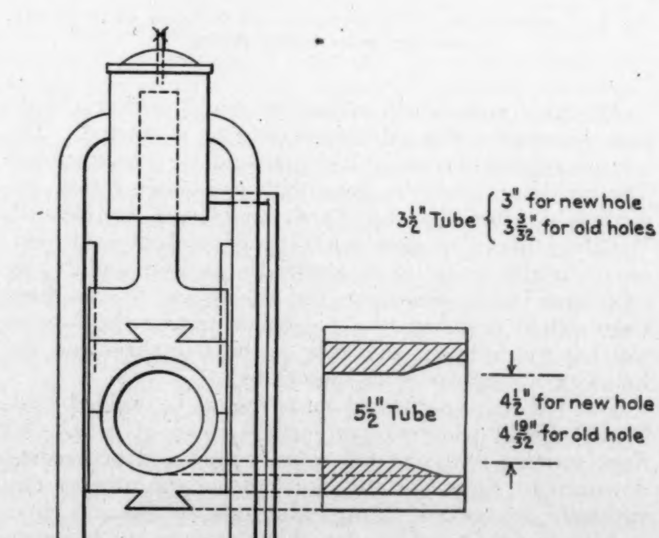


Fig. 7—Size of swages to be used when copper ferrules are eliminated

* Abstract of a paper submitted as part of the report of Committee on Topic No. 2 on the application and maintenance of boiler flues for the 1942 year book of the Master Boiler Maker's Association. Part I appeared in the March issue.

† Mr. Christopherson, who was vice-chairman of the Committee on Topic No. 2, is supervisor boiler inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.

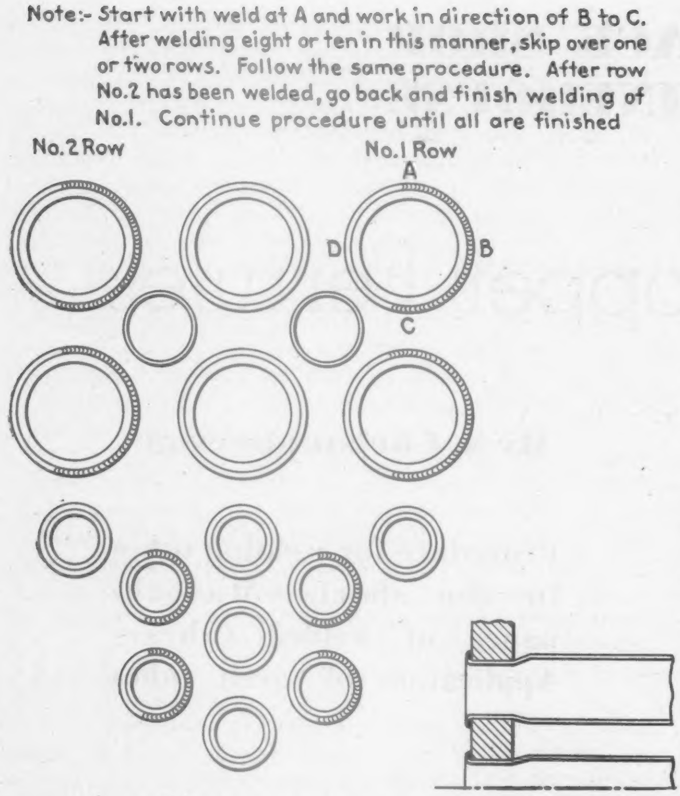


Fig. 8—Sketch of procedure for welding tube and flue beads

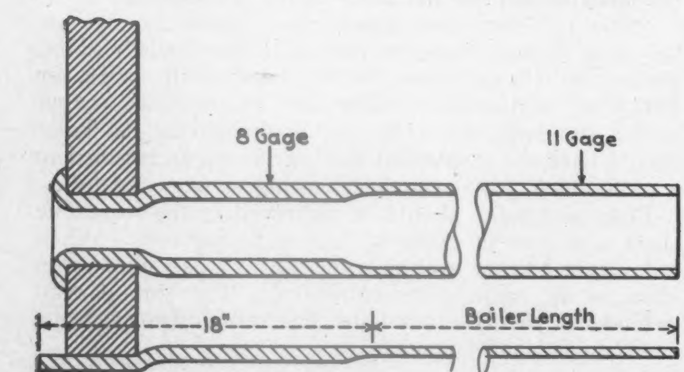


Fig. 9—A combination of two gauges in wall thickness which prolongs tube life under cinder cutting

All flues and tubes should be made perfectly tight and thoroughly cleaned before welding is started. The use of a portable sand-blast machine is recommended. The welding should be done with the boiler empty immediately after the flues are sandblasted or cleaned. Welding should be done with straight-polarity shielded-arc electrodes, using ⅛-in. electrodes for 2-in. and 2¼-in. tubes and 5⁄32-in. electrodes for 3½-in. and 5½-in. flues. Care should be taken to avoid concentrating the heat of welding too long on any area of the flue sheet and the following procedure is recommended.

The 5½-in. superheater flues should be welded first. Work should progress on vertical rows of tubes and flues starting with the top tube or flue and proceeding downward. Start the arc at the top of the tube or flue and weld downward, taking half a tube or flue at a time.

After welding eight or ten tubes or flues in this manner, jump over one or two rows and follow the same procedure. After the second row has been welded, the first row will have cooled sufficiently for further welding. Go back to the first row and clean all scale off the work and then weld the other half of the first row. Overlap the welds at the top and bottom to make certain that there is good fusion.

Skip over one or two rows beyond the second row and weld one half of a row, then return to the second row and finish the remaining half. This procedure should be followed and continued until all the flues and tubes have been welded. It is not necessary to clean the scale from the welds where no further welding will be done as the fire will burn it off.

Maintenance of Welded Flues and Tubes in Service

Heavy working of an electrically welded flue or tube may cause leakage of each of the adjacent flues or tubes. Care should be taken in performing this work.

When flues or tubes are leaking so badly at the firebox end that the locomotive must be taken out of service, the boiler should be drained. The welding on all defective flues or tubes should be cut off and they should be reset with a straight sectional expander; beads should be reset with the beading tool. Flues should be cleaned and rewelded. Tubes should be made tight by the use of a roller expander, rolling lightly; beads should be reset with the beading tool, cleaned and rewelded. If welding facilities are not available, reweld at the first opportunity.

Pin holes in the weld should be caulked with carded tool and hand hammer. Leaking will disclose these defects. The pein of the hammer or a beading tool should never be used. If the leak is under a weld, cut off the defective portion of the weld and reset the flue with a straight sectional expander; roll and bead the defective portion lightly. Clean and reweld.

All the flues and tubes should be inspected not less frequently than at boiler-wash periods and each time the fire is dumped or the locomotive reported as steaming poorly. If found to be plugged, the flues and tubes should be blown, using not less than 90 lb. per sq. in. of air pressure. A flue-blowing pipe not less than the full length of the flue or tube is required. Any clinker formation found on the return bends of the superheater units should be removed with a hook.

Cinder Cutting

We have had very good results from tests of heavy-gauge flues attached to those of lighter gauge. These

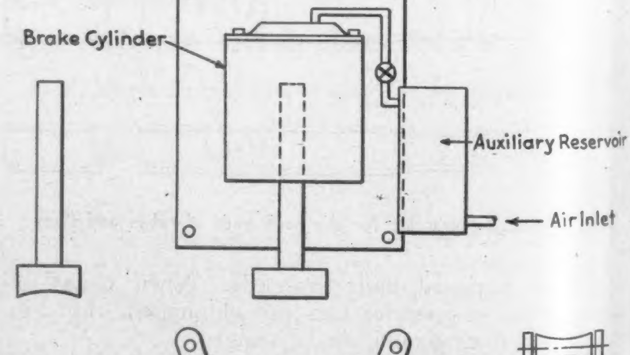
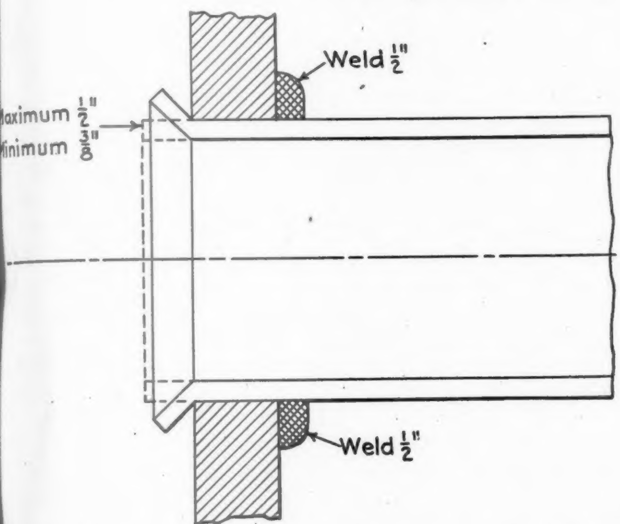


Fig. 10—A device for bending arch tubes

ues were applied to ten 4-6-4 type locomotives carrying 85 lb. boiler pressure during the period from Novem-er, 1940, to July, 1942. Up-to-date, these engines have ade as many as 200,000 miles and no trouble has been xperienced with cinder cutting.

utting, Application and Setting of Arch Tubes

Arch tubes should be cut in a pipe or other suitable achine. The acetylene torch should not be used. Ends hould be free from burrs and be closely fitted into the



ig. 11—A method of reinforcing the door sheet around arch-tube holes

irebox sheets. Tubes should be so bent that they will nter both holes at right angles to the sheets. Care hould be taken in bending to prevent overheating, dis-tortion, or kinking of the tube at the bend. The projec-ion of the arch tubes for belling should be 3/8 in. min-mum to 1/2 in. maximum.

Tubes before being cut should be at least 3 in. longer han the finished length required. Tubes should then be ent and tried out in position in the firebox for mark-ng of the true cutting length. Tubes should be set to ailroad's standard gauges shown on assembly firebrick drawings. No tubes should be expanded and belled until hey have been passed upon by the foreman or inspector n charge. The service life of arch tubes has been greatly improved upon by the building up of the arch-tube hole t the door-sheet end, as shown in Fig. 11. A boss has een built up with electric welding for a depth of 1/2 in., he hole reamed and the boss chamfered. This will give more bearing area and the tube will stay tight. For a period of seven years we have had no leaky arch tube when using the above method. Both ends of the tubes should be tightened, flared, or belled with a flaring roller expander. When the arch tubes have once been flared, no further flaring or belling should be done. If, for any reason, a tube is re-rolled for leakage more than twice, it should be renewed.

When renewing arch tubes, if the holes in the sheet have become oversize or distorted, they should be reamed to a true circle and the radius on the water side of the sheet restored, using a galvanized iron shim. The shim should extend completely around the tube, the ends scarfed and lapped 1/4 in. No arch-tube hole should be enlarged over 1/4 in. by reaming. At this limit a patch should be applied. All arch tubes should be cleaned with a mechanical turbo-cleaner whenever it is found neces-sary, but not less frequently than at boiler-wash periods.

Do not safe-end the arch tubes. The following is recommended for the duration. If the arch tubes are found in good condition after being thoroughly cleaned and inspected and the sheets are not removed for re-newal at the time of a Class 3 repair, arch tubes should be left in the boiler.

Removing Carbon From Piston Valve Spools

Piston-valve spools removed from locomotives at the back shop when they come in for repairs are in most in-stances well coated with carbon, particularly on locomo-tives with high steam temperatures. The removal of this carbon coating, in many shops, is a tedious job of hand scraping. One shop takes advantage of the re-maining heat in annealing or forging furnaces to put the valve spools in the furnace over night, making sure that the temperature of the furnace is not high enough seri-ously to affect the material of the valve spool. The next morning the coating has been loosened to such an extent that its removal is a comparatively simple matter.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on prob-lems relating to welding practices as applied to loco-motive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Welding Guides For Throttle Lever Latch

Q.—We have several locomotives with throttle levers of the type where the latch is supported only by one large headed bolt. This type lever develops lost motion after a few weeks service. Could you suggest a way to correct this trouble?

A.—It is obvious that to eliminate the lost motion the latch must be secured to the lever and still be allowed freedom of movement. This can be accomplished by welding two strips of 1/2-in. square stock along the sides of the lever. These strips are veed on one side and the lever is also veed along the part where the latch moves. This may warp the lever slightly but it is a simple matter to straighten it before machining. After straightening the lever the new strips are shaped out to accommodate a new latch somewhat narrower than the original one. The strips will finish 5/16 in. wide by 3/8 in. high. The new latch will be slightly thicker and narrower than the old one, but the same closing medium will be used, that is, a coiled spring in the slot prepared for it underneath the latch. The pressure of the spring is exerted against a lug on the bottom of the latch. When machining the new latch it is well to leave about .006 in. clearance so that the latch will slide freely but with no lost motion between the newly welded guides. The same large head-ed bolt is used to hold the latch snug in the slot. With the latch thus held securely it can not develop lost motion.

It may be found necessary to make a new latch oper-ating rod. If so, a piece of 1/2-in. by 5/16-in. steel will serve. A piece of 1/4-in. steel 1 in. square is welded to one end of the rod and this is then ground into the shape

of a lug and drilled for the latch end cap screw. The handle end of the operating rod takes a little larger lug. This will be ½-in. thick and 1-in. square. This is also

Filing down the guides for the latch on the throttle lever

welded to the rod, then drilled and reamed for the handle pin. This end is pinned in place and the rod heated with a welding torch and bent so that it will fit in the correct position on the throttle lever. Levers repaired in this manner need little maintenance.

Aligning Cast Iron Parts Before Welding

Q.—What is the correct procedure for welding cast-iron parts having one or more bearings that must be kept in perfect alignment?

A.—As cast iron parts usually break clean without bending or pulling as in steel castings the cast iron part may be fitted together on the welding bench in good alignment. When preparing a cast iron part for welding be careful to keep one surface of the break in approximately a flat position, then when the part is blocked and shimmed to as nearly correct position as possible a small amount of the break is melted out with the welding torch. This small V is then welded. The part is then reversed and the same procedure carried out on the other side. A little more melting and welding can be done on this side. The welder now returns to the original side of the weld, being very careful to block and shim the casting so that it can not sag. More of the crack is melted out and welded and once again the casting is turned over and the same thing done on the reverse side. This alternating procedure is followed until the job is completed. By following this method almost any casting can be welded with satisfactory results.

Applying Hard Facing With The Welding Torch

Q.—What method can be used to build up worn whistle levers and brake valve latches with hard surfacing?

A.—By applying Stellite to whistle levers and brake-valve latches the wear is almost completely eliminated. Grind or file the curved end of the whistle lever to a bright finish. The worn end of a brake-valve latch is usually worn smooth and bright. Then heat the part to a dull red with a carburizing flame using about a 1-in. feather of acetylene. When the base metal starts to sweat apply a small amount of Stellite which will tin similar to bronze. When the end has a thin coating all over, build up to the desired thickness. The part can then be ground to the correct dimensions.

Special Tool Holder For the Boring Mill

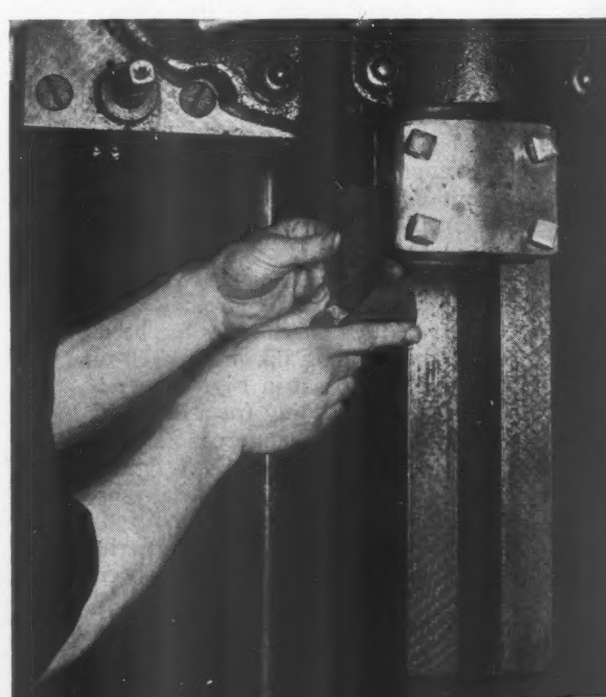
There are a great many occasions when a mechanic would prefer to use a standard tool bit but due to the type of tool post used or the inability to secure the correct size tool bit he has to be satisfied with hand-forged carbon-steel tools.

Faced with this situation a boring mill hand on a small railroad devised a holder whereby he could use ⅝-in. tool bits in a tool post designed for 1-in. tools.

The forged tools for boring had to be bent to get the correct angle of the tool to the work. A tool holder for the ⅝-in. stock was made for this purpose also.

The tool holder for the straight tool was simply a piece of tire steel 1 in. by 1¼ in. by 4 in. long. In this was milled a slot ⅝ in. by ⅝ in. The tool bit can be inserted in the holder and the set screws tightened directly onto the tool bit. In this manner the ⅝-in. tool bit serves as a regular 1-in. tool.

The holder for the boring tool was nearly as simple. This also was made from tire steel 1 in. by 1¼ in. in the shape of an inverted tee, 3½ in. wide and 4½ in. long. The ⅝-in. slot in this holder starts at the lower right-hand corner and extends across the tee at a 45 deg. angle. The top set screw in the tool post tightens on the



T-shaped holder in which the tool is set at an angle

holder; the bottom set screw on the tool bit in the slot.

Any angle desired may be milled in the holder and some operators prefer the tool bit slots on both sides to permit the use of the tool for both turning and boring. These holders are hardened before use.

ELECTRICAL SECTION . .

Uniform brightness of the central lighting fixture is effected by overlapping the ends of the 48-in. fluorescent lamps which produce the light

Continuous Fluorescent Lighting

The Chicago, South Shore & South Bend is now in the process of rebuilding ten coaches equipped with continuous fluorescent lighting. The continuous trough fixture which forms a part of the ventilating duct is located in the center of the car ceiling and extends the full length of the body of the car. The lighting units in this trough are 48-in., 40-watt, 3,500-deg. white fluorescent lamps. There are a total of 16 such lamps in each car and each lamp is placed at a slight angle to the center line of the car, providing a slight overlapping of units. This avoids dark streaks and renders the unit of uniform brilliance. The lamps are placed in an inverted trough and are covered with diffusing plastic shields, made in sections, which can be applied and removed from the trough by springing them into place. No screws, clamps or mounting bezels are required. Lighting on the 45-deg., 33-in. plane ranges from 15 to 20 footcandles.

Power for lighting is supplied by a motor alternator which converts the 32-volt d.c. power on the car to 110 volts at 60 cycles. Both the motor alternator and the lighting equipment were supplied by the Safety Car Heating & Lighting Company.

In addition to the lighting units, the interior of the cars has been completely redesigned. The ceilings have been lowered and new linoleum treatment applied to the end bulkheads, window posts, etc. In addition, the cars have been equipped with a forced ventilating system, which delivers air at the rate of 2,200 cu. ft. per min. to the interior of the car through continuous ducts on either side of the lighting system cowling. The cars are operated singly and in multiple-unit trains from an overhead 1,500-volt d.c. contact system.

Future Electric Transportation

An engineer in the transportation department of one of our large electric manufacturing companies recently received the following inquiry: "Will you please let me know why you don't make an electric auto? You used to make them years ago. I don't see why you couldn't make a coupe that would run 100 miles with one charging and have the batteries made so they could be charged in ten minutes in any service station. If you don't do it, I think Russia will after the war."

To this, he replied in substance as follows: "The American public, in its quest for speed and convenience, long since abandoned the electric automobile. It was too expensive and limited in scope. Until we can explode the atom, or put electrolysis in reverse, the development of a battery-operated coupe will have to be left to the victorious Russians.

"The American public, however, will enjoy greatly improved electric transportation in other forms after the war is won. Although out-maneuvered on small pleasure vehicles, electric propulsion has no equal for railroad and transit use! Aggressively developed and courageously applied, it will afford almost unbelievable speed, comfort and economy!

"Coast-to-coast passenger runs in less than twenty-four

hours are quite possible. Hundred-mile-an-hour freight at one cent a ton-mile needn't be far away. Speedy, convenient, city transit without traffic jams is simply a matter of planning and co-operation. The pleasing part is that these greatly improved services will cost the individual far less in time, money and effort than comparable service with any other private vehicle.

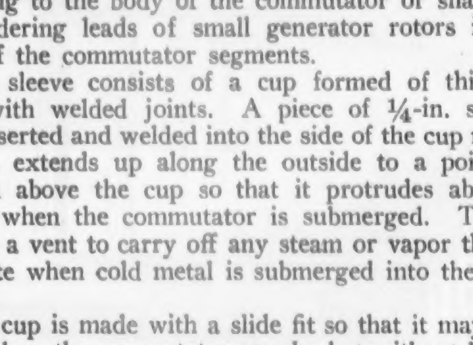
"Modern mass production has been America's successful formula for more goods for more people at less costs. We believe that the same formula can bring equally startling benefits in the transportation field."

Sleeve For Dip-Soldering

A protective sleeve devised by Donald Butter, a plant engineer at General Electric's Schenectady, N. Y., works, prevents molten solder from spattering on the operator or adhering to the body of the commutator or shaft when dip-soldering leads of small generator rotors into the slots of the commutator segments.

The sleeve consists of a cup formed of thin sheet steel with welded joints. A piece of 1/4-in. standard pipe inserted and welded into the side of the cup near the bottom extends up along the outside to a point high enough above the cup so that it protrudes above the solder when the commutator is submerged. The pipe acts as a vent to carry off any steam or vapor that may generate when cold metal is submerged into the molten solder.

The cup is made with a slide fit so that it may be assembled on the commutator snugly, but without bending. It covers the shaft end and about three-quarters of the commutator body. The joint between the commutator body and the cup is taped, sealing it to prevent the entrance of molten solder.



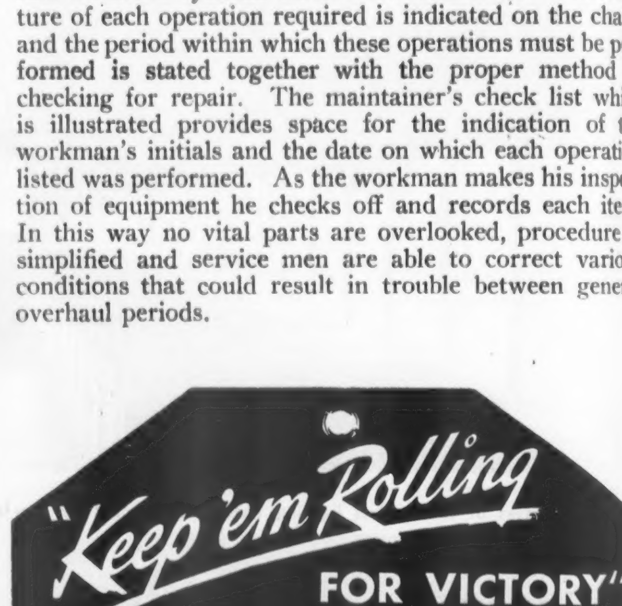
A: Commutator leads to be soldered—*B*: Friction Tape Seal— *C*: Commutator—*D*: Protecting Sleeve—*E*: Solder.

Protective sleeve for dip-soldering prevents spatter and keeps solder where it belongs

The entire rotor is suspended in a vertical position, with the commutator down, on an electric hoist directly over the solder pot. The commutator end with sleeve assembled is completely submerged in molten solder, covering the slots and lead ends. The rotor is left in this position until the leads are thoroughly sweat into the slots, then it is hoisted. The sleeve is easily removed with asbestos gloves, and the rotor is placed on a table to cool.

Maintaining Air-Conditioned Cars

Supervisors charged with the care of air-conditioned cars are being assisted in their work by wall charts and maintenance check lists furnished by the B. F. Sturtevant Company, Boston, Mass. The wall charts list the major points which must be taken care of in both mechanical and water-ice systems on air-conditioned cars. The nature of each operation required is indicated on the charts and the period within which these operations must be performed is stated together with the proper method of checking for repair. The maintainer's check list which is illustrated provides space for the indication of the workman's initials and the date on which each operation listed was performed. As the workman makes his inspection of equipment he checks off and records each item. In this way no vital parts are overlooked, procedure is simplified and service men are able to correct various conditions that could result in trouble between general overhaul periods.



Sturtevant service tag reminds service men of inspections and simplifies procedure when attached directly to each air-conditioning unit

WELL—WELL

By
Walt Wyre

WHEN one of the best wells at the S. P. & W. roundhouse in Plainville started failing, the divison engineer wasn't much worried about water. He figured that the railroad could, as they had in the past, buy plenty of water from the city. When he received notice from the superintendent of the Plainville Power & Light Company that because of increased demand the city could only supply the railroad with a very limited amount of water, then the division engineer was worried and he began immediately to do something about it. Fortunately, a competent driller with good equipment that could start drilling almost immediately was found.

Ned Sparks, electrician for the railroad at Plainville, noticed the steel derrick and inquired about it, but gave it no more thought until about ten days later when Jim Evans, roundhouse foreman, told Sparks that the well was completed and that the division engineer wanted a motor connected the next day to operate a pump to test the well.

"Where is the motor and what kind is it?" Sparks asked.

"I don't know," Evans replied. "The divison engineer said to see the driller. He will show you what is to be done."

Sparks finished the job he was doing, soldering a lead on a dynamo field coil, and walked to the new well. The division engineer and master mechanic were talking to the driller when Sparks arrived.

"Here's the electrician now," the master mechanic commented.

"O. K.," the driller said. "The men are putting the pump in now. The motor is over on the other side of the derrick." The driller started around to the place indicated; Sparks went with him.

"Here it is," the driller said. "The starter is in that crate." He pointed at the crate.

"Looks like it might have been lost off a car loaded with scrap iron," Sparks commented as he stooped to examine the motor.

"Yes, it is pretty old," the driller admitted, but it runs goods. We just use the pump and motor for bringing in and testing new wells."

"It's a 220-volt motor," Sparks said.

"That's right," the driller replied. "Don't you have 220-volt current here?"

"No, all our three-phase power circuits are 440 volts," Sparks told him.

The driller walked around to where the division engineer and master mechanic stood and told them the situation.

"Well, isn't there anything you can do about it?" H. H. Carter, the master mechanic, asked Sparks. "Haven't we got a motor around here that could be used?"

"Bo," Sparks told him, "that is a vertical motor 3600 r.p.m., we don't have anything that could be used."

"Well, it looks like we will have to postpone testing the well until we can get a motor," the driller said. "How long before your new pump and motor will be here?" he asked the division engineer.

"About two weeks," the division engineer replied, then turned to Sparks and asked. "How far would you have to run a line to get 220 volts?"

"About a mile," Sparks said, "and we don't have the wire," he added.

"I sure wanted to get the well tested and move to Sanford and get started on the well there," the driller said.

"Yes, and I wanted to be sure this well will be O. K. when the pump gets here," the division engineer said.

Sparks started to walk away then stopped and said, "It's possible I might be able to connect the winding for 440 volts."

"How long will it take?" Carter asked quickly.

"Oh, about four or five hours, I'd say, but I'd have to have the motor in the electric shop. Of course, it's possible it can't be connected for 440."

"How long will it take to find out?" the driller asked.

"Not long. I'll have to take the end bells off."

"I'm going to the office," Carter said. "I'll tell the storekeeper to send his truck and haul the motor to the electric shop."

WHEN the motor was in the electric shop, it was a matter of just a few minutes to remove the end bells. One look and Sparks wished that he had kept his mouth shut. The motor was connected parallel delta and could therefore be changed to series delta for 440 volts, but the motor had evidently been rewound at some time in a shade-tree electric shop. There was no phase nor pole group insulation and the pole connections appeared to have been playing hide-and-seek and each tried to surprise the others by coming out at the least expected place. In addition the insulation was dry and brittle and would stand very little handling.

While Sparks was examining the winding, the driller and division engineer came in. "How are you coming?" the driller asked. "Are you going to make it?"

"Well, I believe so," Sparks said, "but what about the controller, is it 220 volts also?"

"It doesn't matter," the driller said. "It's just an old style hand controller and the transformer in it is burned out anyway. What voltage do you have at Sanford?" he asked suddenly.

"Two hundred and twenty volts," Sparks replied. "Why?"

"Because," the driller said, "we will want to use the pump and motor to test a well there in two weeks or less."

Then Sparks did wish he had been listening instead of talking when he mentioned reconnecting the motor. He raised up from the motor, scratched his head and said, "I'll be lucky if I get the job done this time without damaging the winding or breaking off a wire right up next to a coil."

"Most of the new motors we get have the wires brought out so they can be connected for either 220 or 440," the division engineer suggested.

"It sure would be fine if you could fix this one that way," the driller suggested.

"O. K.," Sparks agreed with disgust dripping from his voice. "I'll see what I can do."

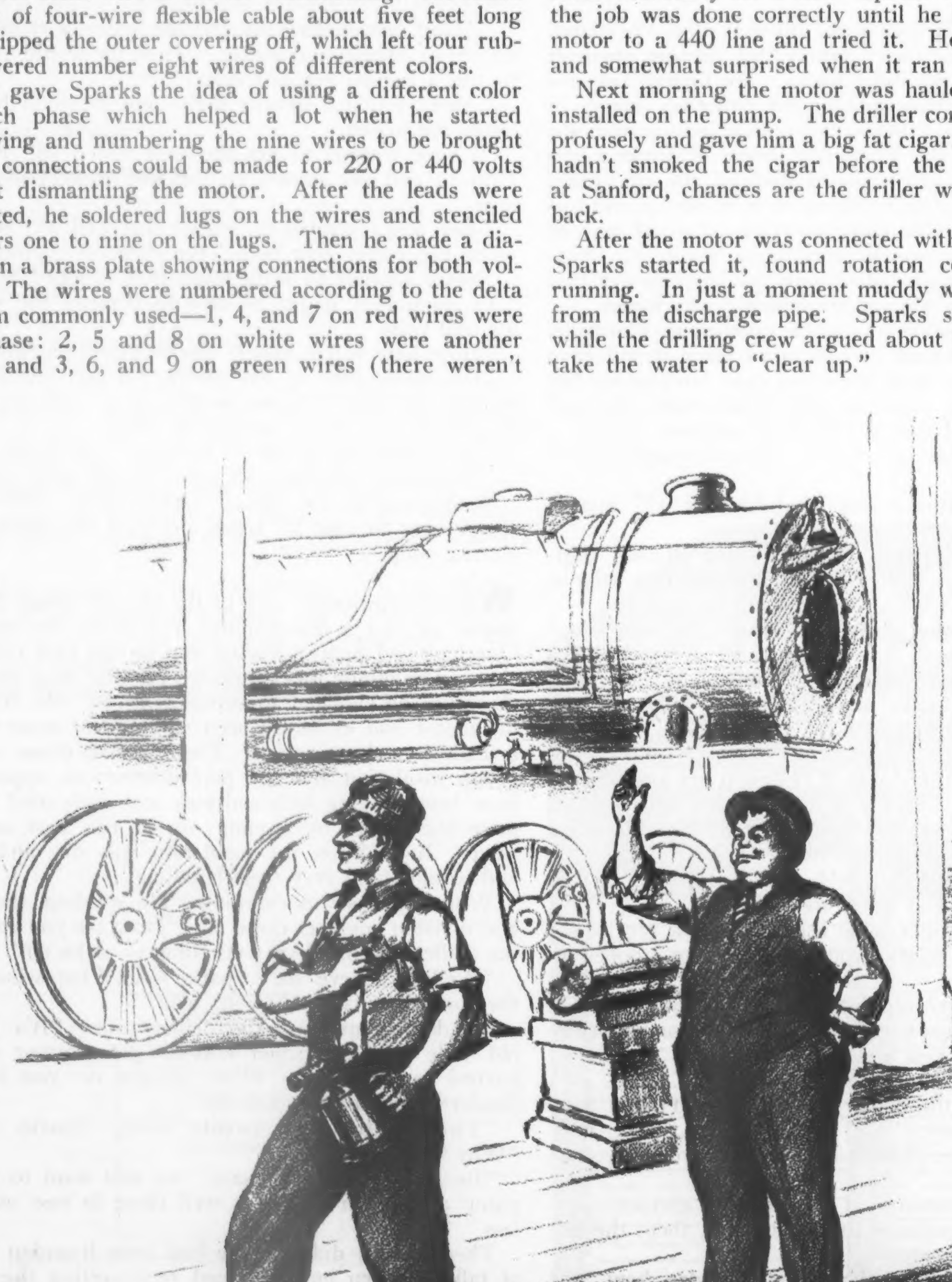
THE two men left and Sparks went to work cutting coil connections and lifting up the leads. He rigged up a series test light to use in locating which lead went where and even then, because of the haphazard arrangements, had trouble keeping the wires straight. When he had the leads cut and leads straightened out he began to search for some wire to use for reconnecting. He found a piece of four-wire flexible cable about five feet long and stripped the outer covering off, which left four rubber covered number eight wires of different colors.

That gave Sparks the idea of using a different color for each phase which helped a lot when he started identifying and numbering the nine wires to be brought out so connections could be made for 220 or 440 volts without dismantling the motor. After the leads were connected, he soldered lugs on the wires and stenciled numbers one to nine on the lugs. Then he made a diagram on a brass plate showing connections for both voltages. The wires were numbered according to the delta diagram commonly used—1, 4, and 7 on red wires were one phase: 2, 5 and 8 on white wires were another phase; and 3, 6, and 9 on green wires (there weren't any blues) were the third phase. When connected 440—1, 2, and 3 were line wires; 4 and 7, 5 and 8, 6 and 9 were connected together to give series-delta connection. For 220 volts, parallel delta, 1, 7 and 6; 2, 8 and 4; and 3, 9 and 5 were to be connected together and line wires connected to each set of three wires.

The haphazard winding and lack of practice by Sparks gave the electrician quite a headache before the job was finished, but the job was finally finished and the motor assembled ready for a test. Sparks wasn't any too sure the job was done correctly until he had connected the motor to a 440 line and tried it. He was well pleased and somewhat surprised when it ran O. K.

Next morning the motor was hauled to the well and installed on the pump. The driller complimented Sparks profusely and gave him a big fat cigar. If the electrician hadn't smoked the cigar before the well was finished at Sanford, chances are the driller would have taken it back.

After the motor was connected with a temporary line, Sparks started it, found rotation correct, and left it running. In just a moment muddy water began to flow from the discharge pipe. Sparks stood and watched while the drilling crew argued about how long it would take the water to "clear up."



Two compliments in two days are just about as much as an ordinary railroad electrician can stand

While he was watching and listening, the roundhouse foreman came up to the well and stopped beside Sparks. After watching a moment the foreman said to Sparks, "We almost have to have some lights underneath the overhead crane in the machine shop. You remember I spoke to you about it over a month ago."

"That's right," Sparks agreed. "I ordered a 500-watt transformer to step the voltage down from 440 to 110, and it looks like a long time before we will get it."

"Now that we are working three full shifts in the machine shop we sure need lights under the crane. Every time it is stopped it cuts the light off from over one or more machines," Evans said. "See if you can't fix up some temporary lights until we get the transformer."

SPARKS' first idea about the lights was four in series across the 440-volt line, but he didn't like that for several reasons. The first reason was that someone might get a good healthy jolt fooling with lights connected that way and the next reason was if one light burned out none would burn and it would be a nuisance locating the one that was burned out.

He had a 440-volt to 220-volt transformer in the shop and decided to compromise and use that with two lights in series. It was a 500-watt transformer which would allow one 200-watt lamp near each end of the crane.

Sparks finished the job next day. The weather was what Californians would call "unusual" if it had been there. Clouds hovering low over the machine shop made it so dark inside that shadows cast by overhead lights were almost as clearly defined as at midnight. When the wiring was finished, Sparks turned the switch. A machinist working at a lathe under one of the lights looked up suddenly and nodded his approval and grinned. Sparks grinned back at the machinist and began to gather up his tools. Evans came into the machine shop and noticed the lights at once. "Good job," the foreman said to Sparks, "just what we have been needing for some time."

Sparks went to the electric shop carrying an arm load of tools and a much inflated ego. Two compliments in two days is just about as much as an ordinary railroad electrician can stand, but next morning the master mechanic had his deflater ready when Sparks came to work. He was waiting in the office when Sparks got his card.

"THE fuel oil pump motor wouldn't shut off last night and the hostler ran about five or six hundred gallons of oil on top of the tank of the 5098." The master mechanic's voice was rough enough to shell corn.

"Quite a mess, I imagine," Sparks commented.

"Yes, but that's not all of it," Carter said. "The Limited came along about an hour later and tried for twenty-five minutes to get oil at the main line crane before they found out the main switch to the fuel pump motor was pulled. Then the motor wouldn't shut off and they ran the tank over on that engine too. Find the trouble right away and let me know and fix it so it won't happen again."

It didn't take long to find out why the fuel oil pump motor wouldn't shut off. Some one when pulling the crane around to take oil had hung the hook in the flexible wire that connected the conduit on either side of the ball joint and shorted the two control wires to the switch on the crane. Sparks corrected the trouble, then went to the office and told the master mechanic what had caused the trouble.

"Seems like there should be some way for a man on an engine at the oil cranes to tell when the motor is running. Can't you fix up an indicator light that will show when the switch is on?" Carter asked.

"Yes, I suppose so," Sparks replied. "Where could I put it so it could be seen from all four cranes?"

"Put it on a pole, or any place where it can be seen," the master mechanic suggested. "I'll go up there after a while and see where to put a light."

Sparks left the office and went to the fuel pump motor to figure how the job of installing an indicator light was to be done. As two-wire control was used on the cranes there was a pair of contactors in the controller not being used. They would serve nicely to turn the light on when the controller contactors were closed and turn the light off when the contactors were open.

"Got it all figured out?" Sparks, busy examining the controller, didn't know the master mechanic was around until he spoke.

"Everything except where to put the light." Sparks closed the door of the controller and straightened up.

"Why not put it on that dog house on top of the water tank at the treating plant?" Carter suggested.

"It could be seen O. K.," Sparks admitted reluctantly. What he thought was, *it's a hell of a long way up there and the tank is too big to put a safety belt around.*

At any rate, Sparks and a helper started to run the line. First trip to the top of the tank the helper started up the ladder like a fireman going up to rescue a pretty girl from a second story bedroom. About half way up the helper stopped all out of breath and Sparks coming up slowly behind overtook the helper.

"What's the matter?" Sparks asked.

"This thing didn't look so tall from the ground," the helper said, "and this hundred foot hand line wasn't heavy when I started."

"Yeah, I didn't think you could keep going at the rate you started," Sparks said. "Now just pretend you are on the ground and start over."

"Wish I was on the ground," the helper complained. "Do you suppose there is any danger of this ladder breaking?"

"If it breaks, I'll turn in a safety card on it," Sparks replied.

It was a mean job installing the light on top of the dog house, but it was completed next day. A blue globe was placed over the 75-watt lamp and it showed up well, particularly at night. The master mechanic was so well pleased with the job that he almost forgot about the spilled oil on the engine tanks and delay to the Limited.

EVERYTHING went along about normal for the balance of the week, with nothing unusual happening. Monday morning there was a wire from the division engineer saying that the well at Sanford would be finished Tuesday and for the electrician to bring wire and other necessary material to connect the motor for testing the well.

The division engineer had previously told Sparks where the well was to be located and the best the electrician remembered it was only about one hundred feet from a three-phase power line. He found about three hundred feet of number six weatherproof wire which he shipped along with about thirty feet of four-wire cable. He arrived in Sanford Monday night.

Tuesday morning Sparks went to the derrick which was not where he had expected it to be. "They decided to change locations," the driller explained.

"Well, I am going to have to have some more wire," Sparks said. "It's over three hundred feet to the nearest power line."

"There are some rolls of wire in the water service shop," the driller said. "I saw them yesterday."

There was some wire, about 800 feet of number 10 rubber covered and that was all the wire to be found anywhere around. Sparks knew the number 10 wire was too small for the 15-horsepower 220-volt motor, but it was all he had. He ran the number 6 as far as it would go, then finished with the smaller wire. He swung the wire on telephone poles that happened to be in the right place. By the time Sparks had finished running the line, the drilling crew had the motor in place ready to connect and it was time to go to lunch.

After lunch Sparks connected the wires to the motor being careful to get the correct numbered lugs together on the motor leads, 1-7-6; 2-8-4; 3-9-5.

"Ready to try it?" Sparks asked.

"O. K.," the driller said.

Sparks shoved the handle of the antiquated controller. The motor buzzed loudly and slowly started turning in the wrong direction. Sparks switched two line wires and closed the controller again. The motor again buzzed loudly and started rotating in the right direction, but slowly. Gradually, too gradually, the motor accelerated until it reached about half speed then accelerated no more. In about two minutes the motor winding started to smoke and Sparks pulled the controller handle to "off."

"Acts like low voltage," the driller suggested.

"I knew that number ten wire was too small," Sparks scratched his head as he spoke, "but I thought it would at least run O. K." Sparks examined the motor connections to be sure they were correct, tested to be certain there wasn't an open in one phase of the line, then tried the motor again. It acted the same as before.

"Looks like we need larger wire," Sparks said.

"Where can you get it?" the driller asked.

"Plainville is the nearest place and I'm not certain about having enough there. I'll have to go get it because I'll have to gather up odds and ends from half a dozen places."

"Well, I'll send one of my men with the pick up to take you, then you can get back before noon tomorrow," the driller offered.

"O. K.," Sparks said, "and believe I'll take the motor and test it, just to make certain there's nothing wrong with it."

IT was two o'clock when Sparks left Sanford. The driver watched the speedometer, sticking pretty close to thirty-five miles an hour. They reached Plainville about five-fifteen.

"Where do you want the motor?" the driver of the pickup asked.

"Let's leave it at the electric shop," Sparks said. "I'll get the portable crane to unload it."

Sparks went into the machine shop looking for the crane. Jim Evans who was in the shop at the time came rushing up to the electrician. "Say, those lights you put in underneath the overhead crane have got a short in them or something," Evans said.

"Won't they burn?" Sparks asked.

"No, the one on the north side burns out bulbs fast as they are screwed in the socket."

"I'll look at it soon as I unload a motor that's outside by the electric shop in a pickup," Sparks told the foreman.

"What time will you be ready to start in the morning?" the driver asked after the motor was unloaded.

"Maybe we had better start about seven o'clock," Sparks suggested.

"O. K.," the driver agreed and drove away.

Sparks picked up a 200-watt lamp and went back to the machine shop. There was a 200-watt lamp in the south socket. Sparks screwed the bulb in the other socket and turned the switch. The lights were O. K.

"That's peculiar," Evans said. "They burned out half a dozen bulbs in that socket last night. Some of them are over there on the bench."

"Why, those are 100-watt lamps," Sparks exclaimed.

"That's right," Evans said. "We didn't need so much light on the north side and I told them to use a smaller bulb in that socket."

Sparks explained how that when burned in series it was necessary for all lamps to be the same, then went to eat.

After supper Sparks returned to the roundhouse and started looking for wire. There wasn't any larger than number 8 to be found and only about 250 feet of that. There was a 500-foot roll of number 10. He decided to use that and parallel it with the number 10 lines already up. That done he went to the electric shop and started testing the motor. It tested O. K., but he still had a premonition it wasn't exactly right.

After debating the question with himself he got the portable crane and hauled the motor to the transformer bank and connected it to the 220 line. The motor behaved exactly as it had in Sanford. He decided that maybe the six and nine were switched and swapped them. The motor behaved as before only more so. Then he hauled the motor back to the electric shop and removed the end bells.

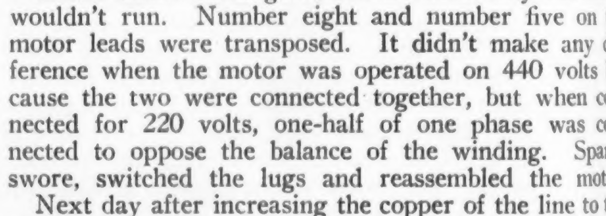
It was almost midnight when he found why the motor wouldn't run. Number eight and number five on the motor leads were transposed. It didn't make any difference when the motor was operated on 440 volts because the two were connected together, but when connected for 220 volts, one-half of one phase was connected to oppose the balance of the winding. Sparks swore, switched the lugs and reassembled the motor.

Next day after increasing the copper of the line to the motor by paralleling the wires, the motor ran O. K.

Sparks still wonders if the motor would have run and carried the load without the additional wires.

What do you think?

* * *



Berwick electric rivet heater in operation at the Huntington, W. Va., plant of the American Car and Foundry Company

CONSULTING DEPARTMENT

Can you answer one or more of the following listed questions? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York, N. Y.

What suggestions can you make for getting best performance out of air-conditioning filters, particularly with reference to present-day operating conditions?

How can I tell when a capacitor is not operating properly?

Long Life for Evaporators and Condensers

What can I do to get the best service and longest life from the evaporator and condensers in our air-conditioned cars?

The More Repairs the Shorter the Life

Most evaporators and condensers of present air-conditioned railway cars are constructed of tinned copper tubing with brass end plates, etc. This construction resists corrosion and provides for long life. Air conditioning equipment must contend with the arch enemy of all electrical apparatus, General Dirt and his lieutenants, lint, pollen, dust, moisture, grease and oil.

The evaporator in the refrigeration cycle of an air-conditioning system is that portion of the apparatus in which the refrigerant is evaporated or changed from a liquid to a gas. The heat removed from the air flows through the fins and tubes of the cooling coil or evaporator and into the refrigerant contained therein. The heat causes the refrigerant to change from a liquid to a gas and the amount of heat absorbed depends on a number of factors including: (1) the latent heat of evaporation of the refrigerant; (2) the average temperature of the refrigerant within the evaporator; (3) the dry bulb and wet bulb temperatures of the entering air; (4) the amount of air passing over the evaporator; and (5) the thermal conductivity of the tubing and fins.

When a report is received from the conductor that a car is not cooling properly, inspection shows too often that it is caused by a dirty or stopped-up evaporator. This will cause low suction pressure for which dry, dirty filters or poor maintenance may be responsible.

The condenser, with its copper tubes and copper fins fastened to the tubes to increase the radiation, is that portion of the apparatus in which the refrigerant is condensed or changed from a gas to a liquid. In other words, the heat absorbed by the evaporator is dissipated by the condenser into the cooling medium air or water. Sufficient heat must be removed to condense the gas into a liquid, and clean condensers are essential. Very dirty or stopped-up condensers, especially on hot days in the summer, will cause high head pressure and cause the high pressure switch to cut the compressor on and off, resulting in another air-conditioning failure.

With the shortage of experienced electricians in railroad air-conditioning maintenance, it is essential that some plan be formed or outlined to maintain air-conditioning equipment properly. To get more efficient and better service as well as longer life from the evaporators and condensers, I would suggest the following procedure for cleaning evaporators and condensers: First, make an inspection when an evaporator is due for cleaning, say twice a year. (A.C. card shows last date cleaned, by whom and where, etc.) Make sure all bolts and piping are tight and secure, to eliminate loose connections on evaporator or condenser which would cause a Freon leak. Soldering and other repairs should be avoided as much as possible. The more repairs you make to evaporators and condensers the shorter their life will be.

For cleaning, we use an iron tank mounted on wheels, like a battery flushing cart, which holds about 40 gals. This we fill about three-quarters full of clean water and add one pint of soda ash or two pints of Oakite. The solution is then heated from a steam hose until it boils. An air connection at the top of the tank allows for connection with an air line. The air pressure forces the solution up to the washing nozzle. Cleaning nozzles are made of pipe tees. These nozzles are bent in various shapes to permit getting at the evaporators from all angles. Air and water lines are brought into the cleaning nozzle with valves to adjust the rate of flow of both air and cleaning solution. The outlet is a small drilled hole.

After the fronts of coils are washed by a slow movement of the nozzles held close to the evaporator, the covers are removed and the evaporator is washed from the back through the plenum chamber. The tank is then filled with clean water and the evaporator coils are thoroughly rinsed. Care must be exercised not to get solution into the ducts or on seats inside of the car as it will spot upholstery, remove paint, etc. We cover seats with a canvas. When the washing is started, be sure the solution or compound is running out freely to ground so there is no danger of the drain pan overflowing and damaging the interior of the car. After coils are washed properly they look like new and are good for another six months. We clean in the spring and in the fall at the start of the cooling and heating seasons, respectively.

Condenser coils can be cleaned the same way, and between times, they may be blown out with air and washed with water. Most condensers are equipped with a screen to keep rocks and sticks from bending the fins or striking the coils. We add a second heavy screen about 24 in. from the first screen. This gives an added protection and we find it keeps the condenser in better shape, thereby increasing its life.

V. W. White,
Electrician,
Illinois Central.

Proper Cleaning and Thorough Rinsing Insures Longevity

The primary function of the evaporator and condensers of the air-conditioning apparatus is heat transfer, the capacity and efficiency of which is based upon service with a clean metallic surface. The evaporator is subjected to a coating for foreign matter (carried in both the fresh and recirculated air) of such density and mass that these particles pass through the air filters and are deposited upon the tubes and fins of the evaporator.

The condensate on the evaporator carries off some of

this foreign matter but a certain amount remains and, in proportion to the service period, a coating is built up on the fins to a thickness which eventually will completely seal the open spaces between the fins. The worst condition will be found on the entering face of the evaporator. This conglomeration of foreign matter consists of lint, coal dust ash, and condensed liquids from human body evaporation which will cause corrosion of the metal in the evaporator and pollution of the air with odors.

The evaporator should be cleaned periodically with a hot alkaline solution. The wash solution should be made up of 5 gal. of hot water at approximately 180 deg. F. and 4 to 5 oz. of Oakite Penetrant, or No. 20 Wyandote Cleaner, or Cowles C. C. Cleaner. The washing solution should be applied with a lift type steam pressure gun. One half of the five-gallon solution should be applied to each face of the evaporator. It is necessary and important that metallic shields be put in place over the face of the evaporator opposite the side being washed for protection of the plenum chamber and painted surfaces, because this hot alkaline solution will injure paint.

After washing with the prepared solution the evaporator must be thoroughly rinsed with approximately 5 gal. of hot water. Particular care must be taken to assure a thorough rinsing of the evaporator and heating radiator because the alkaline solution will have an injurious effect if allowed to remain in contact with either aluminum or tinned copper fins.

The frequency with which the evaporator must be washed depends upon type of service and operating conditions. It is more satisfactory to include this washing of the evaporator with other periodically assigned work to insure regular attention.

The condensers operate under a different condition of encrustations on the fins and tubing by reason of the difference in temperatures and foreign matter in the cooling air. They are subjected to all sorts of dust and dirt common to railroad operation. The worst and most injurious element is an accumulation of coal dust and cinders in the spaces between the fins and tubing, particularly at the bottom section of the condensers. By reason of the higher temperature of the refrigerant gas inside the condenser as compared to the ambient temperature of condenser air, foreign matter is literally baked onto the condenser surface.

To maintain full efficiency and reduce corrosive action on the condensers, two methods of condenser cleaning are recommended. For periodic attention during the cooling season, the interior of the compressor or condenser box should be thoroughly cleaned by brushing or with an air jet. The condensers at the same time should be flushed with water from a hose for removal of all coal dust and other foreign matter from the lower section of the condenser. In this operation the compressor motor must be covered with canvas or some water-proof fabric for protection against moisture. The frequency of this cleaning is governed by the operating conditions as indicated by the condition of the condensers.

At the time of shopping of the air-conditioning apparatus or at other periods not greater than every two years, the condensers should be given a thorough cleansing with an acid solution. For this cleaning the compressor motor should be removed from the condenser unit and the bottom pan and baffle plates at the discharge side of condensers should also be removed to provide access for thorough cleaning.

An acid solution may be made up of 5 gal. of water with 3 qts. of commercial muriatic acid or 20 lb. of Oakite No. 32 chemical. This solution, totalling approximately 6½ gal., should be used on each condenser and applied with the same type of steam-operated, lift-type pressure gun as used for cleaning the evaporator. Half of the solution should be applied on each side of the condenser. After thorough cleaning of each condenser it must be thoroughly rinsed with at least 5 gal. of warm water, using the same steam-operated pressure gun for this operation. If aluminum fins are used in a condenser, the solutions for evaporators should be used.

After complete cleaning of the condensers a thorough inspection should be made for condition of fins and tubing. Fins should be straightened if necessary. The condition of return bends and tube supports in end sheets should be carefully inspected for possible damage caused by expansion of the tubes.

AIR-CONDITIONING ENGINEER

Testing of Oxide Film Rectifiers

What is the best and easiest way to find whether an oxide-film rectifier is shorted or operating properly?

Rectifier May Be Treated as a Resistance

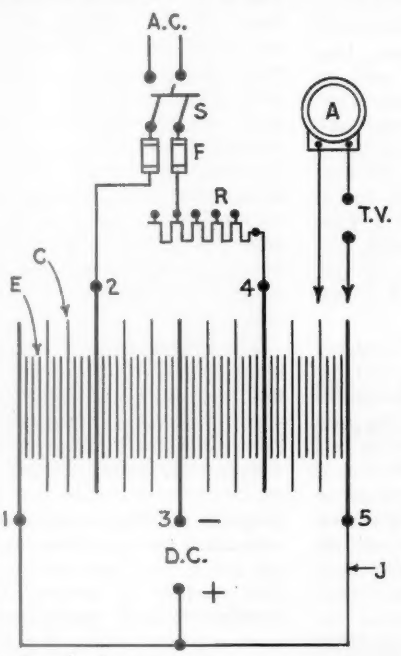
The oxide-film rectifier consists of copper disc elements on which a film of copper oxide has been formed by heating. It is essentially a resistance device which offers low resistance to current flow in one direction and a resistance of 1,000 to 10,000 times greater in the opposite direction. Evidently, when an alternating voltage is impressed across a set of plates, more current flows from the copper oxide on one face to the copper on the other face than in the opposite direction. This characteristic meets the requirements of a rectifier. The resistance of an oxide-film rectifier varies with the number of discs in parallel or in series, the age, the service history and the ambient and operating temperatures. A suitable resistance is connected in series on the a.c. side to obtain the required d.c. voltage on the output side.

The condition of an oxide-film rectifier may be determined by treating it as a resistance device and applying a volt-ampere test. Outside of a suitable source of d.c. voltage, which may consist of a few dry cells, the instruments required for the test are an ammeter, a suitable voltmeter and a milliammeter. A switch and a pair of low rating fuses should be used in connecting the rectifier to the a.c. circuit in measuring the no-load output voltage after the individual elements have tested clear.

A d.c. test voltage of 1¼ volts per disc applied in the rectifying direction should result in a current of the order of 1 ampere, this value depending on the history of the disc and the ambient temperature at the time of the test. A d.c. test voltage of about 6 volts per disc of 1½ in. diameter, applied in a direction opposing the direction of rectification, should allow the passage of a current of the order of 10 milliamperes, also depending on the condition and the temperature of the discs. The current values given are for an ambient temperature of 70 deg. F. It is advisable to test each section of discs separately. The cooling fins which are larger in area and protrude through the sections of discs provide a convenient access for step-by-step test measurements. If the temporary removal of all the interconnections presents considerable difficulty, a less conclusive test may be made by remov-

g the jumper between the two positive terminals, sec-onalizing as many rectifying units as at first readily ccessible and applying the proper test voltage across the o d.c. terminals of each group.

If part or all of a rectifier unit has failed, the current owing in the opposite direction of rectification will be uch higher than specified. In view of this possibility, e test voltage should be gradually built up to six volts r disc to avoid damage to the milliammeter. When



A.C.—A.c. supply source
S—Double pole switch
F—Fuses
R—Series resistor
2 and 4—A.c. supply terminals
3—Negative terminal
1 and 5—Positive terminals
C—Cooling fins
E—Elements, each consisting of a copper disc, coated with a film of copper oxide on one side and a soft metal disc making contact with this oxide at a predetermined pressure
TV—Test voltage: dry cells
A—Milliammeter
J—Jumper to be removed before testing
D.C.—D.c. output

ross section of a full-wave, single-phase rectifier showing how a milliameter is used for testing

defective element in a full wave rectifier unit is not etected and replaced in time, either one or both halves f the unit may break down and cause the a.c. fuse to low. One unit of a rectifier, which may consist of as many units in parallel as the load current may require, s shown in the accompanying sketch. It is always safer o replace the whole unit even though only a section of t is found to be defective. However, during the present emergency where oxide-film rectifiers may not be readily available, an attempt can be made to assemble the good parts of defective units to replace a defective unit.

The life of a well-maintained rectifier is practically un-limited. However, a rectifier ages in service and its out-put voltage may drop as much as 20 per cent depending on the history and combination of discs used. Due to this aging characteristic, the series resistance on the a.c. side is provided with taps. As the output voltage de-creases with aging, the a.c. terminal voltage of the rectifier is raised by reducing the voltage drop across the resistor. The d.c. operating voltage is thus kept within satisfactory limits for a long period of time.

Satisfactory operation can be secured by avoiding un-due overloads, more frequent operation and of longer duration than prescribed, excessive ambient temperatures, insufficient ventilation and excessive applied voltage. Excessive moisture and the presence of corrosive fumes may also shorten the life of an oxide-film rectifier. Overfusing is another common error. The heat gen-erated by a defective unit has often been found to be so intense as to damage adjacent units before the series resistor has burnt out and opened the circuit. In cir-cuit-breaker application, the majority of failures result from the failure of the momentarily closing control relay to trip when the circuit-breaker is closed and the inabil-ity of the circuit-breaker to close due to too low an out-put voltage with the sustained effort of the operator to force the closing of the circuit-breaker by remote control.

R. G. Cazanjian,
Electrical Engineer,
Brooklyn, N. Y.

Resistance Must Be Low In One Direction Only

Copper oxide film type rectifiers as used in railway signaling for fluorescent car lighting and battery charg-ing consist of copper oxide on the surface of copper disks. This combination acts as a valve and passes cur-rent through in only one direction.

The disks can be made in different sizes according to the current capacity desired and groups of disks can be bolted together in series or parallel to provide the proper voltage rating and current capacity.

In testing a dry-disk oxide-film rectifier for trouble, the quickest and easiest way is by using an ohmmeter or Megger. First connect the test leads of the ohmmeter across the terminals of the rectifier and note the read-ing. Then reverse the ohmmeter test leads and again note the reading. If the rectifier is in working condi-tion the resistance should be several times as great on one test as it is on the other.

If both tests produce infinity the unit is open.

If both tests produce zero readings the unit is shorted.

V. W. White,
Electrician,
Illinois Central.

Use An Ohmmeter

The easiest way to determine whether an oxide-film rectifier is shorted or operating properly is to test it with an ohmmeter. An ohmmeter as usually constructed consists of one or two flash-light cells connected in series with a variable resistance and a milliammeter. By re-placing the scale of the milliammeter with a scale prop-erly calibrated in ohms, it is possible to make this com-bination register the resistance of any unknown resistor.

The ohmmeter operates by passing a small amount of direct current through the unknown resistor. If we stop to think for a moment we will realize that an oxide-film rectifier which is in good condition will not allow current to flow through it in both directions. There-fore, its resistance to current flow must be different in one direction than in the other direction.

If we measure the resistance of an oxide-film rectifier in one direction, and then reverse the leads of the ohm-meter and measure the resistance of the rectifier in the opposite direction, we will find that there is a very large difference between the two readings. In fact, if the rec-tifier is in proper operating condition, the resistance in one direction will be found to be very high (approaching infinity), while the resistance in the other direction will be very low. If the rectifier has a short, the resistance in both directions will be low and of about the same value.

Wm. Brewster
Electrical Engineer

— NEW DEVICES —

Conditioner For Metallizing

A Fuse-Bond Unit is now being offered by Metallizing Engineering Company, Inc., Long Island City, N. Y. which is used to prepare surfaces of metal parts for metal-

Metal can be prepared for spraying at the rate of three to four square feet per hour

lizing. The unit consists of a transformer mounted on casters which supplies current to a metal electrode. The electrodes fuse on the surface of the metal to form a multitude of irregularly shaped cavities, the result being a rough and porous anchoring surface. The work itself is not heated sufficiently to cause a change in its grain structure. The process eliminates the need of blasting or rough threading; and after the surface has been prepared the sprayed metal is applied as usual, with a gas flame.

Joint Sealing and Anti-Seize Compound

A non-hardening and non-expanding joint sealing and anti-seize compound known as Bestolife lead seal No. 270, has been developed by the I. H. Grancell Company, 1601 East Nadeau street, Los Angeles, Calif. It contains a high percentage of finely powdered metallic lead, and is suitable for use on pipe joints, studs, staybolts and other screw thread fittings. It may be used on air, oil and steam-line connections under any operating temperature conditions. Joints, studs, and staybolts assembled with the compound can be broken out easily when necessary.

A Purifier for Diesel Engine Oil

A contact-filtration type purifier, developed by the Youngstown Miller Company, Inc., Sandusky, Ohio, is now being used on several railroads for reclaiming Diesel-engine crank-case oil. The particular unit illustrated is a Model A-75 which has a capacity to treat 75 gal. in 70 to 90 min. without presettling or pre-treatment of the crank-case oil. The unit occupies a floor space 79 in. by 56 in., is 89 in. high and weighs about 3,000 lb. Machines of this type are available in sizes from 8 to 200 gal. capacity.

The equipment includes a well-insulated open-ventilated heating tank with a 1-hp. electric-driven agitator shaft and propeller centrally mounted and dynamically balanced. A small blower fan mounted on this shaft just under the lid of the tank is used to remove vapor and gas which forms on top of the oil. A secondary transfer tank with conical bottom is piped to receive oil and clay mixture from the heating tank and deliver it under air pressure to a filter press from which clean oil is drawn for re-use in the Diesel engines.

The Chromalox heating elements, built into the tank walls, are designed to operate at low temperatures and are said to last the life of the machine. The heaters are turned on manually and turned off automatically by thermostats, this condition being indicated by a light on top of the machine. The agitator motor is manually controlled but interlocked so as to be always in operation when the heaters are o[n]. The 1-hp. dirty-oil charging pump is started manually and stopped automatically by float switch. The dual control thermostats are responsive to the tank wall temperatures and provide a degree of protection even if the heaters are turned on with the tank empty. They are set so that one thermostat, controlling half of the heating elements, will cut out about three minutes before the other to allow ample time for normalizing the temperatures of the heated zone before the oil is dropped out of the heating tank. A thermometer is installed to indicate temperatures in the oil heating tank.

The filter press is of the Y.M. two-stage plate and frame type, clean oil coming from the first stage and then passing through a second polishing stage before leaving the filter. The clean oil leaves the filter under sufficient pressure to return directly to the engines or to overhead storage tanks. The complete purifier forms a sturdy, compact unit, ready for installation and service without any special foundation or holding bolts. The machine is designed to use various common refinery earths available on the open market. Filter papers, supplied by the manufacturer, can be used over and over.

The purpose of this equipment is to remove non-lubricating volatiles from Diesel engine oil by slow heating, and solids and asphaltic material by filtering. It is capable of removing fuel dilution, water, acids, solid and colloidal carbon, dirt etc. Inso far as the contaminants are concerned, th[e]

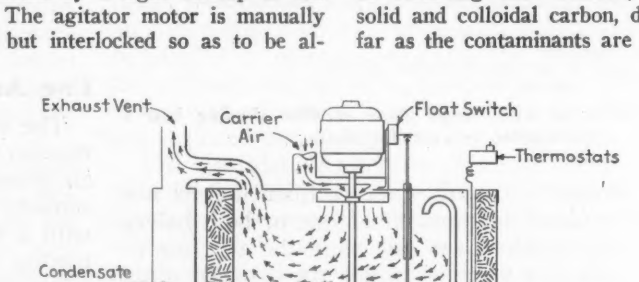


Diagram showing principal parts of the Y.M. Diesel engine oil purifying equipment

is said to be restored for re-use to the ivalent of new oil, with acidity reduced new low values and asphaltic materials irely removed. The quality of the clean is said to be uniform from the beginning

ungstown Miller Model A-75 unit designed to purify Diesel engine crank case oil

the end of each batch and from batch batch.

The process for treating the oil is the me in all models of Y.M. purifiers. The rty oil is pumped into the heating tank; filtering earth is added; and the oil is ated to evaporate the water and fuel lution. The vertical motor-driven proller keeps the oil and clay mixture in olent agitation. The blower fan draws r into the still to entrain the vapors as ey come out of the oil and carry them to e exhaust vent. If this draft of carrier r were not provided, the space above the l would soon become saturated with the apors and removal of the water and dilun would be incomplete. When the oil s been sufficiently heated, as determined the signal light, it is filtered to separate from the dirty earth which entrains ms, sludge, solid particles of metal, dust, rt, etc., coloring matter and acids. The l is thus restored with full lubricating operties, and is clear with a good color pproximately that of new oil.

Ballasts for Fluorescent Lamps

A complete line of fluorescent lamp ballasts now being made by the Jefferson Electic Co., Bellwood, Ill. The latest of these one to operate four 100-watt lamps. Two mps are operated in series (they start in equence) on each leg of the ballast cirit, the legs being lead and lag branches r power-factor correction and maximum imination of stroboscopic effect. This ethod of using fluorescent lamps increases ght output per watt by eight per cent and

High-power-factor two-, three-, and four-lamp ballasts reduce current and minimize stroboscopic effect

markedly reduces fixture weight. Fixture cost is reduced about 20 per cent and the ballast cost is about one-half that entailed with two-lamp units. The four-lamp circuit also saves about 50 per cent of critical materials required for making the ballasts.

Plastic Case on Portable Electric Drill

A portable electric drill of ¼-in. capacity which has a grip handle, field case and gear case constructed of a tough, light-weight plastic—Thorite—is being released for general sale by the Independent Pneumatic Tool Company, Chicago. This Thor drill

A plastic case makes this drill light and easy to handle

has been in production for a year but all output was required for previous commitments on military orders. Service performance is said to prove that power output per pound is greater, strength and protection from shock increased, and that the unit is cooler in operation than previously produced units.

Eye Protection For Flame Welders

Development of a new eye-protection glass, Didymium-Noviweld, which permits the eyes of gas welders to pierce blinding glare and see welding operations from beginning to end, is a development of the American Optical Company, Southbridge, Mass. Lenses made of the new glass possess all the ray-absorptive properties of American Optical's Noviweld glass, plus the special characteristics of Didymium, a combination of elements with high absorption in that particular portion of the visible spectrum where "flux flare" normally obstructs clear vision.

In all types of flame welding, the new Didymium-Noviweld safety goggle lenses cut down the high-intensity sodium rays of the fluxes. Flame workers can thus look through the yellowish cloud of "flux-flare," see the rod and molten area more clearly, and thereby step up their efficiency in every phase of the welding operation, particularly the flame welding of aluminum and steel. The lenses also protect eyes by absorbing the harsh, tiring, invisible ultra-violet and infra-red rays generated during welding.

Paint Spraying From Original Cans

A recently developed clamp-type cover permits the use of original quart-size, friction-top paint containers in spray-painting operations. The cover fits standard type paint cans and it may be used in connection with most of the commonly used hand-spraying units. This top is also useful in permitting rapid changes from one color to another without the necessity of cleaning containers between changes. The cover unit can be cleaned and clamped on a can of different colored paint in a short time. The Master Manufacturing Company, Chicago, has introduced this cover.

A clamp-type cover for spraying equipment which fits any standard quart-size paint can

High Spots in

Railway Affairs . . .

Governmental Planning For the Post-War Period

The bureaucrats at Washington are busy doing everything they can to dig in and assure their future when peace comes. The country was amazed when, on March 10, the President sent to Congress the report of the National Resources Planning Board on "Security, Work and Relief Policies." At the same time he transmitted another report from the board, entitled, "National Resources Development Report for 1943." In its findings and recommendations on transportation the report contained this clause: "Transportation Modernization. We recommend: (1) A National Transportation Agency should be created to co-ordinate all Federal development activity in transportation, absorbing existing development agencies, and co-operating actively with regulatory agencies. The agency would be responsible for unifying government transportation planning, administrative and development functions, and would assume leadership in consolidation, co-ordination and reconstruction of transportation facilities and services." The report then went on with recommendations for public responsibility for basic transport facilities through terminal reconstruction and Federal credit for the provision of new facilities. In making recommendations for each media of transportation it included, among other items applying to the railroads, this statement: "Consolidation of railroads into a limited number of regional systems by legislation, with appropriate authority granted to the Transportation Agency to enable such a program to be carried out vigorously."

Re Government Ownership

The Transportation Association of America, Inc., takes issue with the National Resources Planning Board on several features concerning transportation, in its report to Congress. It has this to say about government ownership of the railways: "Support of private enterprise, which the public is justified in expecting, finds no place in the recommendations of the National Resources Planning Board. Government financing is advanced as inevitable when it should be resorted to only after all efforts to bring about private financing have been exhausted. If the government invested heavily in transportation it would, as do all investors, naturally and logically insist upon a degree of supervision; next would come domination; final result—government ownership. . . . Government ownership is not inevitable. There is no public liking for it; there is no public demand for it. It can creep up on us, however, if we are too greatly absorbed in our own petty personal affairs to the neglect of important government issues; if we fail to subordinate selfish interests to the good of our revered republic; if we permit ourselves to forget that eternal vigilance is the price of liberty."

Pullman Records Broken

Approximately two billion passenger-miles were traveled by Pullman on American railways during the month of January. This includes both military and civilian traffic and is 57 per cent in excess of the performance for January, 1942. Total Pullman passenger-miles for the year 1942 exceeded 19 billion, far outstripping the previous all-time record of 14.4 billion in 1926. In addition to the heavy troop movements, civilian requirements have also stepped up sharply.

"Austerity" Locomotives

Shortage of labor and materials has forced the British to go to locomotives of a "simple and robust design." The term "austerity" has been adopted in that country for articles of all sorts that have been redesigned to accommodate them to war conditions. It is perfectly natural, therefore, that these new locomotives should be termed "austerity" locomotives. A number of them have been built in this country, although not directly to the British design. Our builders furnished an equivalent design, but in order to produce it economically had to incorporate certain American features. In commenting upon this, the Railway Gazette of London recently said: "Few locomotive types can have had their portraits taken so often, in so short a time, as the American-built 'Austerity' engines. . . . The striking appearance of these engines, coupled with the fact that they are symbols of an international friendship of immense historical significance, causes them to be the focus of great interest wherever they go. . . . In course of time they will no doubt earn for themselves the tribute which enginemen in this country nearly always pay to notable new classes and be given a nickname expressive of their qualities and of the sentiments they have inspired. We have as yet no inkling of what this nickname is likely to be, but in an American journal the legend beneath a picture of one of the class described it as 'an iron doughboy in battle-dress.' This, to use another American expression, is something of a bibful and we feel sure that our men will soon improve on it with a name both terse and apt."

Labor's Responsibilities

Director Joseph B. Eastman, of the Office of Defense Transportation, urged labor to give more thought to its responsibilities at a "Keep 'Em Rolling Rally" in Philadelphia, on March 5. Included in his remarks were these statements: "'Uneasy lies the head that wears the crown.' Power brings with it responsibilities. It is also very easy to abuse. When the 'vested interests' had power they abused it. So did the bankers. I wish that along with what is properly said about the rights of labor, more time were spent on the responsibilities which go with power. I have been fortunate enough in my time to know many business men, bankers, lawyers, public office holders and labor leaders. Every one of these groups has its racketeers, its would-be Hitlers, and its tricksters. And every one has its men of honor and responsibility and devotion to the public good. In my judgment, the percentages are about the same in the case of all these groups. I feel that labor unions are in some danger. They are new to power. Here and there it has gone to their heads somewhat, and in some cases they have allowed abuse to creep in. They are for liberty and democracy, they are against tyranny and despotism, but have they always carried these precepts into practice in their own affairs? They demand that business men be held to public accounting, but are they willing to be so held themselves? The pendulum always swings from one extreme to the other. There is danger of a public reaction against labor unions, and already I see signs that it is setting in. If their houses are not in order, I suggest that they clean these houses themselves."

Standard Gage from Egypt into Turkey and Iraq

The completion of a strip of standard-gage railway between Beirut and Tripoli in Syria will make it possible to travel over standard-gage railway lines from Egypt through Palestine and Syria, into Turkey and Europe on the north, and as far east and south as Baghdad in Iraq. While the low level route along the coast between Beirut and Tripoli was chosen to avoid extensive bridge work if the line was projected away from the coast, it did involve some difficult engineering. Several tunnels, one at least a mile long, had to be cut through almost solid rock. The work on this last link connecting the standard-gage lines was performed in record time. A working force of 3,000 men completed the task in nine months, using materials from India, Burma, Turkey and the United States.

(*Turn to next left-hand page*)

NEWS

Leiserson, Schwartz NMB Appointees

CONFIRMATION by the Senate on February 25 of President Roosevelt's nominations of Dr. William M. Leiserson and former Senator H. H. Schwartz of Wyoming to be members of the National Mediation Board has restored the full membership of that Board which was left with only one active member—Chairman George A. Cook—when David J. Lewis retired on February 1. Dr. Leiserson has since been elected chairman of the N.M.B. succeeding Mr. Cook.

Dr. Leiserson, a former member of N. M. B. who was transferred in 1939 to the National Labor Relations Board, has been appointed to the National Mediation Board for a full three-year term ending February 1, 1946. Since last June he has served as chairman of the National Railway Labor Panel which President Roosevelt's May 21, 1942, executive order created to provide wartime procedures whereby labor-management disputes in the railroad industry may be submitted to emergency fact-finding boards without the necessity for taking strike votes. Dr. Leiserson continues also as chairman of the panel.

Former Senator Schwartz, defeated for reelection last November, was appointed for the unexpired term, ending February 1, 1944, of Otto S. Beyer, who resigned after having been on leave of absence for more than a year while serving on a full-time basis as director of the Office of Defense Transportation's Division of Transport Personnel.

WPB Car Deliveries for First Half of 1943

RELEASES have been granted by the War Production Board covering the building of 19,971 of the 20,000 cars authorized by the board for construction during the first six months of 1943. One of the accompanying tables summarizes the cars released by types; the other, the reported allocations to railroads and builders.

Summary Table of WPB Authorizations

	Contract Car Builders	Railroad Shops	Total
Hopper	8,355	1,150	9,505
Gondola	4,048	2,735	6,783
Ore	2,100	....	2,100
Flat	725	701	1,426
Tank	120*	....	120
Special Box	37*	....	37
	15,385	4,586	19,971
Unallocated	29	....	29
Total	15,414	4,586	20,000

* Ordered by industrial companies.

WPB Appointments

DONALD M. NELSON, chairman of the War Production Board, has appointed Charles E. Wilson, former president of the General Electric Company, as executive vice-chairman "in charge of all WPB programs." Ferdinand E. Eberstadt, program vice-chairman, has resigned at the request of Mr. Nelson. Ralph J. Cordiner, who has been director-general for war production scheduling, has become a vice-chairman of WPB and serves as a special assistant to Mr. Wilson. J. A. Krug, director of the Office of War Utilities, has been named vice-chairman of the WPB in charge of materials distribution. He is also chairman of the Requirements Committee and continues to serve as War Utilities director. Donald D. Davis, recently director of the Program Bureau, is now WPB vice-chairman for operations. Curtis Calder, former director general for operations, is executive assistant to Mr. Wilson.

William L. Batt continues to serve as a WPB vice-chairman, and Col. Robert E. Johnson, head of the Smaller War Plants Corporation, retains the rank of deputy chairman.

Freight-Car-Building Program, First Six Months, 1943
WPB Authorizations Reported to February 27

Name of Railroad	No.	Type	Builder
Ann Arbor	50*	Hopper	Company Shops
Atchison, Topeka & Santa Fe	300	Ore	American Car & Foundry
	200*	Hopper	Pullman-Standard
	200*	Gondola	Pullman-Standard
Atlantic Coast Line	550*	Hopper	Bethlehem Steel Co.
	700*	Gondola	Bethlehem Steel Co.
	300*	Flat	Pullman-Standard
Baltimore & Ohio	525*	Hopper	Bethlehem Steel Co.
Bessemer & Lake Erie	800	Ore	Pullman-Standard
Central of Georgia	100*	Hopper	Pullman-Standard
Central of New Jersey	500*	Gondola	Bethlehem Steel Co.
Chesapeake & Ohio	500*	Hopper	General American
	1,250*	Hopper	Pullman-Standard
	38*	Gondola	Mather Stock Car Co.
Chicago & Illinois Midland	630	Gondola	General American
Chicago, Milwaukee, St. Paul & Pacific	400*	Flat	Company Shops
	735*	Gondola	Company Shops
Chicago, Rock Island & Pacific	400*	Gondola	Pressed Steel
Denver & Rio Grande Western	450	Gondola	Mount Vernon
	220	Gondola	Pressed Steel
Duluth, Missabe & Iron Range	500	Ore	Pressed Steel
Elgin, Joliet & Eastern	300	Hopper	Ralston
	440	Gondola	Ralston
Great Northern	500	Ore	General American
International- Great Northern	100*	Flat	American Car & Foundry
Lehigh Valley	500*	Hopper	Bethlehem Steel Co.
Louisville & Nashville	650*	Hopper	Pullman-Standard
Missouri Pacific	450*	Hopper	American Car & Foundry
New York Central	300*	Flat	Despatch Shops
	1,000*	Gondola	Despatch Shops
Norfolk & Western	100*	Gondola	Pressed Steel
Northern Pacific	300*	Flat	American Car & Foundry
	250*	Hopper	American Car & Foundry
Pennsylvania	1,000*	Gondola	Company Shops
	1	Flat	Company Shops
Reading	700*	Hopper	Company Shops
Southern	1,450*	Hopper	Pullman-Standard
	1,000*	Gondola	Mount Vernon
Union Pacific	1,000*	Hopper	American Car & Foundry
Wabash	400*	Hopper	Company Shops
Western Maryland	25*	Flat	American Car & Foundry
Industrial Companies	105	Tank	General American
	15	Tank	American Car & Foundry
	37	Other	General American
Unallocated	1,100		
Total	19,971		

* Composite wood and steel construction.

Car Plants Must Use Surplus Inventory Stocks

ACTION intended to require freight-car builders to use their surplus inventory stocks and thereby reduce the volume of new material required was taken February 24 by the War Production Board in the form of Supplementary Limitation Order L-97-a-1, amended, a further revision of the April 4, 1942, order "freezing" car materials, which already had been liberalized to allow exchanges of materials in stock.

The order in its present form is intended not merely to permit, but to require, reductions of stocks of surplus parts. It is designed, the WPB states, to relieve situations where car purchasers specify accessories of different manufacture than those in stock, and directs the builder to substitute parts on hand, where they are interchangeable, for those specified by the purchaser.

Equipment-Purchasing and Modernization Programs

CANADIAN NATIONAL.—The first 50 units of an order for 900 all-steel 40-ton box cars have been delivered to the Canadian National at Hamilton, Ont., by the National Steel Car Corporation. It is anticipated

(*Continued on next left-hand page*)

At Lima particular attention is paid to the application of staybolts. This care in every phase of construction has an important bearing on future locomotive maintenance.

that approximately 15 of these cars will be completed daily when the builders get into full production.

Missouri Pacific.—The Missouri Pacific has been granted permission by the District Court to spend $8,566,345 for improvements to its roadway and equipment. Of this total, $7,216,830 will be spent on the Missouri Pacific; $693,765 on the New Orleans, Texas & Mexico; $530,820 on the International Great Northern; and $124,930 on the Missouri-Illinois.

New York, Chicago & St. Louis.—The Nickel Plate has applied to the Interstate Commerce Commission for authority to assume liability for $1,230,000 of equipment trust certificates to be issued in connection with the financing of the purchase of the 10 locomotives of the 2-8-4 type ordered from the Lima Locomotive Works as noted elsewhere in this issue. The total cost of the locomotives is expected to be $1,567,485.

St. Louis-San Francisco.—The road has been authorized by the District Court to spend $3,138,246 for improvements to road and equipment during 1943. The trustees also plan to purchase 20 locomotives, including 10 Diesels and 10 steam, at a cost of $2,735,330.

Approved Steam Locomotive Orders

THE accompanying table summarizes the domestic railroad steam locomotive building situation and groups locomotive orders and allocations previously reported separately from time to time in the table of Orders and Inquiries for Equipment published each month in the *Railway Mechanical Engineer*. Where the month in which deliveries are scheduled to begin was not available, the locomotives are simply listed as for delivery this year. While all of the locomotives are reported to have government authorization for building, WPB confirmation to this effect has not been received.

Orders and Inquiries for New Equipment Placed Since the Closin[g] of the March Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Atchison, Topeka & Santa Fe	10[1]	4-8-4	Baldwin Locomotive W
Baltimore & Ohio	20	2-8-4-4	Baldwin Locomotive W
Bessemer & Lake Erie	5[1]	2-10-4	Baldwin Locomotive W
Chesapeake & Ohio	40	2-8-4	American Locomotive C
New York, Chicago & St. Louis	15[1]	2-8-4	Lima Locomotive Wk
Pennsylvania	50	2-10-4	Company Shops
Southern Pacific	20[2]	4-8-8-2 (pass.-fit.)	Baldwin Locomotive W

[1] For 1943 delivery.
[2] Approximate cost $5,000,000. Delivery expected to begin in October.

Certain railroad orders placed in 1942 were increased in size early this year when WPB approved the building in 1943 of a larger number of locomotives for these particular carriers than were already on order. Thus, the Atchison, Topeka & Santa Fe, which had 20 4-8-4 type locomotives on order since November, 1942, received WPB authorization this year covering the building of 30 engines of this type, the order for the additional ten being placed in February. The Bessemer & Lake Erie, which had five 2-10-4 type locomotives on order but "frozen" since April, 1942, received authorization covering the building of 10 engines of this type, the order for the additional five being placed in February.

Railroad orders placed in 1942 which are reported still without WPB authority to build include the Chesapeake & Ohio order for ten 0-8-0 type engines for switching service placed in January with the Lima Locomotive Works; the Detroit, Toledo & Ironton order for four 2-8-2 type engines for freight service placed in April with Lima; the Indianapolis Union order for three 0-8-0 type engines for switching service placed in June with the Baldwin Locomotive Works; and the Lehigh & Hudson River order for three 4-8-2 type engines for freight service placed in May with Baldwin.

Proceedings Coordinated Mechanical Associations

THE reports and addresses prepared fo[r] the 1942 year books of two of the Co[-] ordinated Mechanical Associations hav[e] been published as follows:

Master Boiler Makers' Association.—A. F. Stiglmeier, secretary-treasurer, 2[…] Parkwood street, Albany, N. Y. 142 pages. Price, $5.

The Railway Fuel and Traveling Engineers' Association.—T. Duff Smith, secretary, 327 South La Salle street, Chicag[o]. 198 pages. Price, $3.

Army Invites Suggestions for New Devices and Methods

CIVILIANS as well as soldiers are invite[d] by the Army Engineers to send in thei[r] suggestions for new devices and methods which may help the Army do its vital wor[k] more efficiently. The whole range of Army techniques is embraced in the Engineers invitation and, of course, including a[ll] phases of transportation.

Suggestions should be sent to the Engineer School, Fort Belvoir, Virginia. S[o] far 11 per cent of the ideas submitted hav[e] been put to practical use.

Railroad Steam Locomotive Building Program, 1943

Name of Railroad	No.	Type	Service	Date of Order	Date of Delivery	Builder
Atchison, Topeka & Santa Fe	20*	4-8-4	Freight	Nov. '42	1943	Baldwin Locomotive Works
	10	4-8-4	Freight	Feb. '43	1943	Baldwin Locomotive Works
Baltimore & Ohio	20	2-8-8-4	Freight	Feb. '43	1943	Baldwin Locomotive Works
Bessemer & Lake Erie	2	0-8-0	Sw.	Apr. '42	1943	American Locomotive Company
	5*	2-10-4	Freight	Apr. '42	1943	Baldwin Locomotive Works
	5	2-10-4	Freight	Feb. '43	1943	Baldwin Locomotive Works
Central of Georgia	8*(a)	4-8-4	Pass. & Frt.	Nov. '42	June '43	Lima Locomotive Works
Chesapeake & Ohio	40	2-8-4	Pass. & Frt.	Feb. '43	Late 1943	American Locomotive Company
Delaware & Hudson	15	4-8-4	Freight	Feb. '42	1943	American Locomotive Company
Denver & Rio Grande Western	6(a)	4-6-6-4	Freight	Sept. '42	1943	American Locomotive Company
Duluth, Missabe & Iron Range	10	2-8-8-4	Freight	Mar. '42	Dec. '42-Mar. '43	Baldwin Locomotive Works
Lehigh Valley	10*	4-8-4	Freight	Nov. '42	1943	American Locomotive Company
Missouri Pacific	15*	4-8-4	Freight	Nov. '42	1943	Baldwin Locomotive Works
Nashville, Chattanooga & St. Louis	10*	4-8-4	Freight	Nov. '42	1943	American Locomotive Company
New York Central	25	4-8-2	Freight	Feb. '42	Nov. '42-Jan. '43	Lima Locomotive Works
	25	4-8-2	Freight	Jan. '43	July-Aug. '43	Lima Locomotive Works
New York, Chicago & St. Louis	10	2-8-4	Freight	Feb. '42	1943	Lima Locomotive Works
	15	2-8-4	Freight	Feb. '43	Oct. '43	Lima Locomotive Works
Norfolk & Western	10	2-6-6-4	Freight	Apr. '42	Jan.-Mar. '43	Company Shops
	5*	2-6-6-4	Freight	Apr. '42	1943	Company Shops
Northern Pacific	12	4-6-6-4	Freight	Feb. '42	Jan. '43	American Locomotive Company
	10*	4-8-4	Freight	Feb. '42	1943	Baldwin Locomotive Works
Pennsylvania	25	2-10-4	Freight	Mar. '42	Feb. '43	Company Shops
	10	2-10-4	Freight	Sept. '42	Mar. '43	Company Shops
	50	2-10-4	Freight	Jan. '43	1943	Company Shops
Richmond, Fredericksburg & Potomac	10	2-8-4	Freight	Mar. '42	Jan.-Feb. '43	Lima Locomotive Works
St. Louis-San Francisco	10*	4-8-4	Freight	Nov. '42	1943	Baldwin Locomotive Works
St. Louis Southwestern	5	4-8-4	Freight	1942	Dec. '42-Feb. '43	Company Shops
Southern Pacific	30	4-8-8-2	Pass. & Frt.	Mar. '42	Nov. '42-Mar. '43	Baldwin Locomotive Works
	10	4-8-4	Freight	Mar. '42	Apr.-May '43	Lima Locomotive Works
	20	4-8-8-2	Pass. & Frt.	Feb. '43	Oct. '43	Baldwin Locomotive Works
Union Pacific	25	4-6-6-4	Freight	Feb. '42	1943	American Locomotive Company
Western Pacific	6	4-8-4	Freight	July '42	Apr. '43	Lima Locomotive Works
Total	489					

* These locomotives ordered in 1942, as shown in date of delivery column, but building not authorized by War Production Board until after January 1, 1943.
(a) Order originally placed with Baldwin Locomotive Works and subsequently otherwise allocated by WPB.

(*Turn to next left-hand page*)

Truck Spring Snubbers Excessively Loaded

A CIRCULAR letter issued recently by the A. A. R. Mechanical Division, calls attention to reports that some truck spring snubbers recently placed in service are failing due to being applied to spring clusters where the free height of the standard truck springs is reduced to a considerable extent. These reports have been considered by the Committee on Car Construction and the Joint Committee on Helical Springs for Freight Cars.

It is stated in the circular letter that where snubbing devices are used with old springs (which may be corroded and have taken a considerable permanent set), an undue burden is placed on the snubbing devices, which may be the cause of their early failure.

When spring snubbers are applied, it is recommended that the entire spring cluster be checked carefully to insure a minimum average free height of 8 in. for springs remaining in each nest. Springs badly corroded or pitted should be replaced. Also, if the spring at the preferable location f the snubbing device has a greater fr height than any of the other springs in t cluster, it should be relocated in place the spring having the lowest free heig

Rejection of springs with excessive (denoting fatigue and with little service remaining) at the time of the snubber plications should greatly reduce the dama caused by broken springs, as well as e pense and delay in subsequent replacemen according to the letter signed by Executi Vice-Chairman V. R. Hawthorne.

Supply Trade Notes

FRED C. DAVERN has been appointed manager of railroad sales for the Standard Oil Company of New Jersey.

◆

COPPERWELD STEEL COMPANY.—*William J. McIlvane* has been appointed vice-president in charge of sales and assistant to the president of the Copperweld Steel Company, Glassport, Pa.

◆

WESTINGHOUSE AIR BRAKE COMPANY.—*G. L. Cotter* has been appointed district engineer at Chicago to fill the vacancy caused by the death of *J. S. Y. Fralich.* Mr. Cotter, a mechanical engineering graduate of the University of Michigan, entered the service of the Westinghouse Air Brake Company as a special apprentice in 1923. He was in the engineering department and test division, commercial engineering division, and district engineer for the central district. In 1940, he was promoted to the position of commercial engineer in charge of the commercial engineering division, which position he held until his current promotion.

G. W. Misner, a graduate of the University of Michigan in mechanical engineering, entered the employ of the Westinghouse Air Brake Company as a special apprentice in 1924. He joined the commercial engineering division in 1929 and was appointed district engineer for the central district in 1938.

T. W. Masterman, a graduate of the School of Industries, Carnegie Institute of Technology, began a special apprenticeship course with the Westinghouse Air Brake Company in 1920, immediately after graduation, and served successively as special engineer, field engineer, and test engineer. He was transferred to the commercial engineering division in 1930, from which position he was promoted to district engineer.

◆

WHITING CORPORATION (CANADA), LTD.—*H. M. Rowlette* has been elected vice-president and general manager, with headquarters at the company's new offices at 45 Richmond street, W., Toronto, Ont., to succeed *Colonel James Mess,* who is now employed full-time with government duties at Ottawa. Mr. Rowlette has been with the parent company, the Whiting Corporation, at Harvey, Ill., since 1912.

THOMAS A. EDISON, INC.—*William W. Gould,* electrical supervisor for the Reading at Philadelphia, Pa., has joined the Thomas A. Edison, Inc., Edison Storage Battery division, as field engineer with headquarters at Philadelphia. Mr. Gould was graduated from the University of Manitoba with a degree in electrical engineering in 1925, and his first railroad work was with the Illinois Central, where he was power supervisor from 1925 to 1938. Prior to his association with the Reading, he was with Jackson & Moreland Consulting Engineers for 12 years and worked on design, inspection and constru tion in connection with the suburban ele trification of the Delaware, Lackawanna Western.

William W. Gould

◆

MAGNUS CHEMICAL COMPANY, INC.—*J. D. Holmes* has been appointed mana of the newly organized Feedwater Tre ing Division of the Magnus Chemical Co pany, Inc., Garwood, N. J.

◆

BY-PRODUCTS STEEL CORPORATION.—*Harry R. Meyer* has been appointed ge eral manager of sales, with headquarters Coatesville, Pa. Mr. Meyer was forme manager of direct sales for the Luke Steel Company, of which the By-Produ Steel Corporation is a subsidiary.

◆

PITTSBURGH PLATE GLASS COMPANY.—*W. I. Galliher* has been appointed executi sales manager of the Columbia Chemic division of the Pittsburgh Plate Gla Company, succeeding *Eli Winkler,* w continues with the company in the capa of executive consultant. *Louis F. Thea* industrial sales manager of the Milwauke (Wis.) paint division has been appoin west coast divisional director, succeedin *Floyd S. Green,* retired. *R. I. Ogle,* i dustrial paint sales representative in t Chicago territory has been appointed indu trial sales manager at Milwaukee.

Army-Navy E Awards

S. E. Bowser & Co., Inc., Fort Wayne, Ind. Second award.
Edward G. Budd Manufacturing Company, Philadelphia, Pa. Third award.
Bullard Company, Bridgeport, Conn. Second award.
Caterpillar Tractor Company, Peoria, Ill. March 12.
International Nickel Company, Huntington, W. Va. Fourth award.
Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. Second award.
Pressed Steel Car Company, McKees Rocks, Pa. March 23.
Union Asbestos and Rubber Company, Chicago. February 22.

Obituary

UNITED STATES STEEL CORP.—*Perci Roberts,* a member of the first board directors of the United States Steel Co poration, who served on the board for years prior to his retirement in 1935, d March 6. He was 86 years of age.

◆

GENERAL ELECTRIC COMPANY.—*John Barry,* honorary vice-president of the Ge eral Electric Company, died on March He was 75 years of age. Mr. Barry tired as senior vice-president of Gene Electric on July 1, 1935, after more th 45 years' service. He entered the electri industry as an apprentice and test man w the Thomson-Houston Company, a pre

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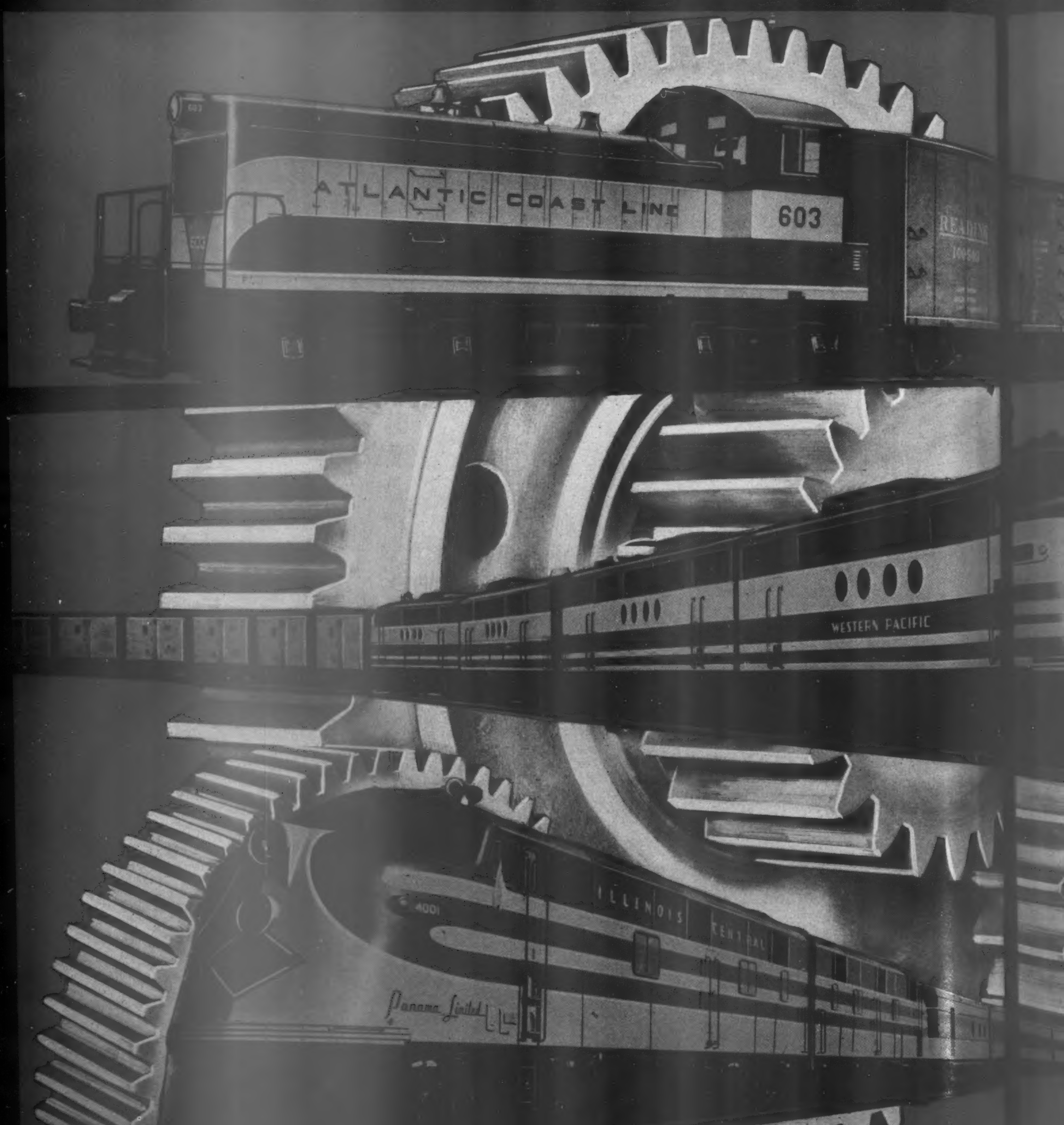
PULLING

TO WIN THE WAR



cessor of General Electric, at Lynn, Mass., in 1885. Completing his apprentice training in 1890, he was assigned to the construction department of Thompson-Houston, later going to the company's Boston, Mass., office. In 1892, when the General Electric Company was formed, he became a member of the railway department. He was transferred from Boston to New York, and then to Schenectady, N. Y., where he became assistant manager of the railway

John G. Barry

department in 1897, and manager in 1907. He was appointed to the position of general sales manager in 1917, while still retaining the managership of the railway department, and became a vice-president in June, 1922. Mr. Barry played an active role in civic affairs in Schenectady, serving as a member of the board of education and as fuel administrator for the district during World War I.

◆

ARTHUR A. HALE, vice-president and a director of the Griffin Wheel Company, died at Coral Gables, Fla., on February 21. Mr. Hale was born in 1884 and was

Arthur A. Hale

a graduate of the University of Illinois in 1905. On July 1 of that year Mr. Hale entered the employ of the Griffin Wheel Company as assistant to the chief engineer and on May 26, 1911, was appointed sales agent at Boston, Mass. On August 1, 1922, he was promoted to the position of eastern sales manager, with headquarters at New York, and on June 1, 1927, was elected a vice-president. A year later he was transferred to Chicago and on February 6, 1939, became a director.

◆

CLAUDE W. BENDER, who retired on April 1, 1938, as general manager of the Mississippi Valley division of the lamp department of the General Electric Company, died on January 24. Mr. Bender was 66 years of age. He had been associated with the General Electric Company for nearly 30 years and at the time of his death was acting in an advisory capacity for the Mississippi Valley division. He began his career in the electrical department of the Altoona, Pa., shops of the Pennsylvania in 1889, leaving railroad work for a few months in 1902 to join the Royal Hanna Coal & Coke Co. as electrical engineer. He returned to the Pennsylvania in that same year as a draftsman in the electrical engineering department at Altoona and was appointed assistant to the electrician, motive power department, Lines East, in 1903. He joined the National Lamp Company (later the National Lamp Works of the General Electric Company) as commercial engineer in 1909 and was appointed manager of the commercial development department in 1913. He was appointed manager of the division which was the forerunner of the Mississippi Valley division at St. Louis, Mo., in 1923, from which posi-

Claude W. Bender

tion he retired in 1938. Mr. Bender prepared the Railway Electrical Engineers' Handbook, Electric Light and Illumination, which was published by the engineering department of the National Electric Lamp Association.

◆

FORT PITT MALLEABLE IRON COMPANY, DAVIS BRAKE BEAM CO.—*Frank J. Lanahan,* president of the Fort Pitt Malleable Iron Company of Pittsburgh, Pa., and the Davis Brake Beam Company of Johnstown, Pa., died on March 2. He was 72 years of age.

◆

STANTON HERTZ, vice-president and assistant to the president of the Copperweld Steel Company, Glassport, Pa., died on February 27. Mr. Hertz was 48 years of age. He was a graduate of the Alabama Polytechnic Institute and was a lieutenant in the Engineers Corps in World War I. He began his career with the Copperweld Steel Company in 1921 and served s cessively as chief engineer at the N York office, general manager of sales a

Stanton Hertz

vice-president. He was executive direct of the Copper Wire Engineering Associ tion from 1936 to 1941, and returned Copperweld in 1941 as vice-president a assistant to the president.

◆

JAMES G. BLUNT, assistant to the vi president in charge of engineering of American Locomotive Company, who d on February 15, as noted in the March sue, was 74 years of age. He received degree in mechanical engineering from University of Michigan in 1894. Duri his early business career he was employ as a machinist at the Buda Company, Ha vey, Ill.; a draftsman at the Welland Ir

James G. Blunt

Works, Welland, Ont., and a draftsman the employ of the Bucyrus Company a the Industrial Works, Bay City, Mich. 1897 he took a position as draftsman wi the Brooks Locomotive Works at Dunkir N. Y., becoming chief draftsman in 18 In 1906, following the formation of American Locomotive Company, of wh the Brooks Locomotive Works became part, Mr. Blunt was transferred to Sch nectady and appointed engineer of drafting department. He became mech ical engineer in 1916, chief mechanical gineer in 1936, and assistant to the vi president in charge of engineering in 19

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Personal Mention

General

Clarkson T. Hunt, master mechanic of the Philadelphia division of the Pennsylvania at Harrisburg, Pa., who has been appointed superintendent of motive power of the Southwestern division with headquarters at Indianapolis, Ind., as announced in the March issue, is a graduate of Lehigh University, and entered railway service on

Clarkson T. Hunt

June 21, 1915, in the Altoona (Pa.) works of the Pennsylvania. He served in various capacities on several divisions of the Eastern region and in the general offices at Philadelphia, and on October 16, 1939, was appointed master mechanic of the Philadelphia division. On February 1, 1943, he became superintendent of motive power of the Southwestern division.

V. L. Green has been appointed assistant mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis.

Alfred E. Calkins, assistant to the general superintendent, motive power and rolling stock of the New York Central with headquarters at New York, has retired after 51 years of service.

M. P. Nunnally, since July 1, 1942, acting mechanical engineer of the St. Louis Southwestern, has been appointed mechanical engineer, with headquarters at Pine Bluff, Ark.

W. F. Freutel, general electrical inspector of the Chesapeake & Ohio, has been appointed assistant electrical engineer, with headquarters at Richmond, Va. The position of general electrical inspector has been abolished.

H. G. Miller, assistant mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed mechanical engineer, with headquarters as before at Milwaukee, Wis.

S. J. Fuller, former general foreman, car department, who has been serving as assistant mechanical engineer of the St. Louis Southwestern since July 1, 1942, is now assistant mechanical engineer.

E. J. Kueck, mechanical engineer of the St. Louis Southwestern, has been appointed assistant superintendent of motive power, with headquarters at Pine Bluff, Ark.

W. W. Bates, assistant district master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed assistant to the superintendent of motive power, with headquarters as before at Milwaukee, Wis.

Edgar M. Whanger, assistant to the vice-president of the Pere Marquette, with headquarters at Detroit, Mich., has been appointed assistant to the president. Mr. Whanger was born on August 29, 1899, at Fort Spring, W. Va., and obtained his college education at Washington and Lee University, Lexington, Va., graduating in 1919. He first entered railway service on March 4, 1912, with the Chesapeake & Ohio, serving intermittently while attending school, as a messenger, timekeeper and accountant in the transportation, mechanical and stores department. In July, 1921, he became a machinist apprentice, in which capacity he served at Hinton, W. Va., and Clifton Forge, Va., until September, 1925, when he became a machinist at Huntington, W. Va. In the following month he was appointed mechanical inspector of lo-

Edgar M. Whanger

comotives and other equipment on the Hocking Valley (part of the C. & O.) at Columbus, Ohio. In September, 1929, Mr. Whanger was assigned to special work for the C. & O., the H. V. and the P. M., with headquarters at Cleveland, Ohio. On February 1, 1930, he was named special representative in the office of the vice-president, maintenance and operation, of the P. M. at Detroit, and was appointed assistant to the vice-president in May, 1937.

J. E. Brown, whose promotion to superintendent of motive power of the St. Louis Southwestern with headquarters at Pine Bluff, Ark., as announced in the March issue, was born at Andover, Ill., on November 26, 1877, and is a graduate of Washington University, St. Louis, Mo. (1897). He entered railway service on January 1, 1900, with the Kansas City Southern and one year later became a draftsman in the employ of the St. Louis Southwestern at Pine Bluff. On January 1, 1917, he was appointed mechanical engineer; on October 16, 1923, assistant superintendent of motive power, and on February 1, 1943, superintendent of motive power.

C. H. Bilty, who has retired as mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific, as announced in the March issue, was born in Milwaukee, Wis., on January 21, 1877. He was educated in public and private schools and entered railway service in 1894 as a machinist apprentice at the old West Milwaukee, Wis., shops of the Chicago, Milwaukee & St. Paul (now the C. M. St. P. & P.). From March, 1899, to March, 1900, he was a machinist; until September, 1907,

C. H. Bilty

a draftsman, and until April, 1910, chief draftsman. While serving as a draftsman Mr. Bilty attended night school for the study of mathematics. In April, 1910, he became mechanical engineer of the Milwaukee; in April, 1918, was appointed mechanical engineer, Northwestern region, U. S. R. A., and on June 15, 1920, returned to the Milwaukee as mechanical engineer. During the Spanish-American War Mr. Bilty served as an infantry private with the 4th Wisconsin Volunteers. He is a life member of the Association of American Railroads, Mechanical Division, and a member of the American Society of Mechanical Engineers, Western Railway Club, Veteran Employees' Association, and Milwaukee Hiawatha Service Club.

Master Mechanics and Road Foremen

F. L. King, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at La Crosse, Wis., has been granted a furlough to enter military service.

H. E. Niksch, assistant to the superintendent of motive power of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed division master mechanic, with headquarters at LaCrosse, Wis.

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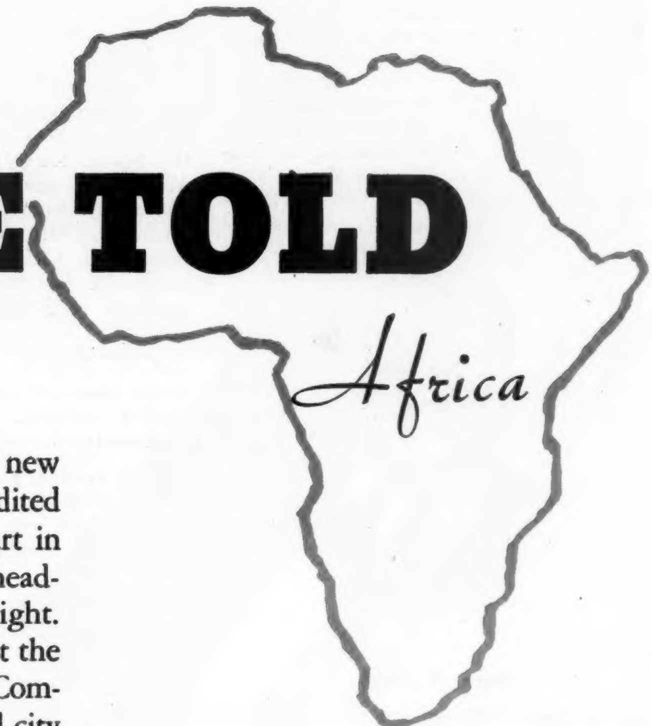
Now

T CAN BE TOLD



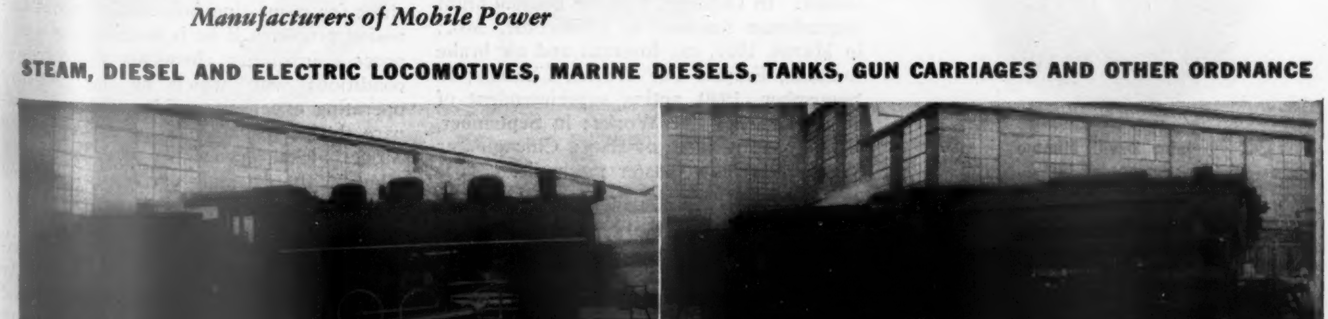
SCHENECTADY—home of the Army's new wonder weapon, the Tank Killer credited with having played an important part in shattering Rommel's Afrika Corps, forcing it into headlong flight in Libya – is again in the national spotlight. Even though the new weapon was in production at the Schenectady plant of the American Locomotive Company for months, and thousands of employees and city residents knew what it was that was being built, not a word about it leaked out to the outside world. As a result, in newspapers throughout the country and on national radio programs, the men at the plant have received high praise and Schenectady itself has become known as "The City That Kept a Secret".

Officially called the M-7, this new weapon was invented when American Army observers with the British Army in Egypt returned to this country with reports of equipment that was needed to stop the Nazi tanks. Army engineers built a wooden model of the weapon they thought would do that, and in March, 1942, American Locomotive engineers were called upon to produce test models. These were built within a few weeks and were successfully tried out by the Army at the Aberdeen Proving Grounds. Since last June M-7's have been rolling out of Schenectady bound for the battle front – *America's answer to Rommel.*

AMERICAN LOCOMOTIVE

Manufacturers of Mobile Power

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES AND OTHER ORDNANCE



Also many Alco Locomotives have enlisted in our Armed Services

H. S. Roo has been appointed assistant district master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at Milwaukee, Wis.

Frank N. Burch, assistant master mechanic of the Central of Georgia, who has been appointed master mechanic at Macon, Ga., as announced in the March issue, was born on November 28, 1886, at Paducah, Ky. He attended grammar school

Frank N. Burch

and in June, 1902, entered the employ of the Illinois Central at Paducah. After completing his apprenticeship he served on various railroads and in October, 1913, became a machinist in the shops of the Central of Georgia at Macon, and in June, 1917, assistant master mechanic of the Macon, Dublin & Savannah at Macon. He returned to the Central of Georgia in July, 1918, as a machinist, where he later served as machine-shop foreman, erecting-shop foreman and, from June, 1924, until February 1, 1943, as assistant master mechanic.

John David Nimmo, general foreman of the Gulf, Colorado & Santa Fe at Cleburne, Tex., who has been appointed master mechanic of the Gulf division, with headquarters at Silsbee, Tex., as announced in the February issue, was born on March 29,

John David Nimmo

1891, at Topeka, Kan. Mr. Nimmo attended public school at Cleburne and from June 6, 1905, to August 31, 1905, he was employed at tool room boy of the Gulf, Colorado & Santa Fe at Cleburne. He became boilermaker helper at Cleburne on June 9, 1906; machinist apprentice, on April 1, 1907; and machinist on January 18, 1912. He was transferred to Gainesville, Tex., on June 21, 1914 as a machinist and on October 30, 1915, returned to Cleburne as an apprentice instructor. On December 15, 1916, he became assistant day enginehouse foreman at Cleburne and on April 1, 1920, general foreman, locomotive department with the same headquarters. Mr. Nimmo was appointed general enginehouse foreman at Gainesville, Tex., on December 1, 1931, and on February 1, 1939, returned to Cleburne as general foreman, locomotive department. He became master mechanic at Silsbee, Tex., on January 1, 1943.

R. L. Turner, general foreman of the South shops of the Southern, has been appointed assistant master mechanic, with headquarters as before at Atlanta, Ga.

G. S. Gandy, general foreman, locomotive department, of the St. Louis Southwestern, has been appointed master mechanic, with headquarters at Pine Bluff, Ark.

Harrison L. Price, who has been appointed master mechanic of the Atchison, Topeka & Santa Fe with headquarters at Chanute, Kan., as announced in the March issue, was born on November 27, 1898, at Kearney, Neb. He attended Topeka, Kan., high school, and on February 7, 1916, entered the employ of the Atchison, Topeka

Harrison L. Price

& Santa Fe as a machinist apprentice. After completing his apprenticeship he was a machinist at Topeka, and later at Shopton, Iowa. Mr. Price was appointed apprentice instructor at Shopton in May, 1926. In February, 1929, he again became a machinist and later served as an inspector and on special assignments. In November, 1935, he entered the test department at Topeka, as a test department assistant. In October, 1936, he became night enginehouse foreman at Chillicothe, Mo.; in March, 1937, car foreman and air brake foreman, Empire Car Works, Chicago; in September, 1940, acting superintendent of shops, Chicago Car Works; in September, 1941, superintendent of shops, Chicago Car Works, and now master mechanic.

Car Department

J. W. Ziehm, former traveling car foreman, who has been serving as general foreman, car department, of the St. Louis Southwestern since July 1, 1942, is now general foreman, car department.

Shop and Enginehouse

V. V. Vior, enginehouse foreman of the Chesapeake & Ohio at Hinton, W. Va., has been promoted to the position of general foreman at Hinton.

R. A. Scott, enginehouse foreman of the St. Louis Southwestern, has been appointed assistant general foreman, with headquarters at Pine Bluff, Ark.

Robert Malley, a machinist in the employ of the St. Louis Southwestern, at Pine Bluff, Ark., has been promoted to the position of enginehouse foreman.

L. H. Cain, assistant general foreman, locomotive department, of the St. Louis Southwestern, has been appointed general foreman, with headquarters at Pine Bluff, Ark.

Purchasing and Stores

R. I. Renfrew, assistant general storekeeper of the New York Central at Beech Grove, Ind., has been appointed assistant general supervisor of stores, with headquarters at New York.

C. S. White, general purchasing agent of the New York Central has been appointed manager, purchases and stores, with headquarters as before at New York. The position of general purchasing agent has been abolished.

Trade Publications

Copies of trade pulications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

Revised Standard Steel Analysis Chart.—American Steel & Wire Company, Sales Promotion and Advertising Department, Rockefeller Building, Cleveland, Ohio. Chart, in folding form, covers carbon and free cutting steels, manganese, nickel, nickel chromium, and molybdenum steels as well as chromium, chromium vanadium, silicon manganese, and National Emergency steels. Embraces all modifications and changes in analyses of AISI, SAE and the new NE steels up to February 1.

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Corrosion Data Work Sheet.—The International Nickel Company, Technical Service, 67 Wall street, New York. Engineer or executive may utilize this work sheet for requesting information about corrosion problems if he is undertaking a new process involving chemicals or corrosive conditions with which he has not had operating experience; if he wishes to compare the performance to be expected from Monel, nickel, Inconel, or other metals and alloys with materials previously used and found unsatisfactory, or if he cannot get nickel or nickel alloys because of priorities and needs corrosion data on substitute materials. Most practicable data will then be selected from available Inco Technical Service Data and interpreted in the light of the particular needs set forth.

ANDERSON
Eitherend

WELDING CABLE CONNECTORS

For convenience in electric welding, Anderson Eitherend cable connectors provide a simple means for coupling together lengths of single conductor cable. Neither male nor female, just insert one connector within the other and the juncture is complete. The ends are exactly alike and no mistake can be made. Eitherend cable connectors have no bolts or other loose parts that take time to adjust.

Thousands in daily use all over the country. Made in cable sizes from No. 6 to NO. 0000. Soldered or solderless connection.

TYPE CC Receptacle. The standard passenger car charging receptacle for many years.

ARMY E NAVY

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No. 9 in a Series of Tips on "Keeping 'em Turning"
by Arch Metzgar, 43 years at LeBlond.
I'm Tellin' You...
Eight of my sidekicks here at LeBlond have already given you lathe operators some tips on taking care of your machines. But I'd like to hand out some reminders on how to take care of yourself. A lathe really isn't a dangerous machine unless the operator gets careless or forgets one of these common sense rules. A good way to be sure you'll be on the job every day is to remember all of them.
YEARS 40 SERVICE
LeBLOND
STOP
STOP YOUR MACHINE BEFORE YOU -
1. Caliper your work
2. Clean chips from work or tool
3. Oil or wipe machine
FASHION NOTE - No. 1
Save your eyes. They're the only pair you have. Wear goggles when your operation makes the chips fly.
FASHION NOTE - No. 2
Jewelry is excess bag-gage. Don't wear rin wrist watch, or pocke chain. You might ge the whirl of things fore you know it.
HOLD TIGHT
Mount work securely, clamp as close to tool post as possible. Be sure tool is in correct position.
WATCH YOUR STEP
See that the floor around your lathe is always clean. Keep oil wiped up. It's slippery. Don't let chips and shavings pile up. Don't let your mind wander.
FASHION NOTE - No. 3
Don't feature a collegiate drape shape in your work clothes. Wear tight fitting clothes with no tie, or tie tucked in. Roll up your sleeves.
ARMY E NAVY
THE R. K. LeBLOND MACHINE TOOL CO
CINCINNATI, OHIO
Largest Manufacturer of a Complete Line of Lathes